THE

FARMER'S SCHOOL BOOK,

DESIGNED AS A READING BOOK

IN

COMMON SCHOOLS:

CONTAINING THE MOST IMPORTANT INFORMATION ON

PRACTICAL AGRICULTURE,

ORIGINAL AND SELECTED FROM THE BEST ENGLISH AND AMERICAN WORKS ON AGRICULTURE.

BY J. ORVILLE TAYLOR.

ALBANY:

PUBLISHED BY THE COMMON SCHOOL DEPOSITORY.

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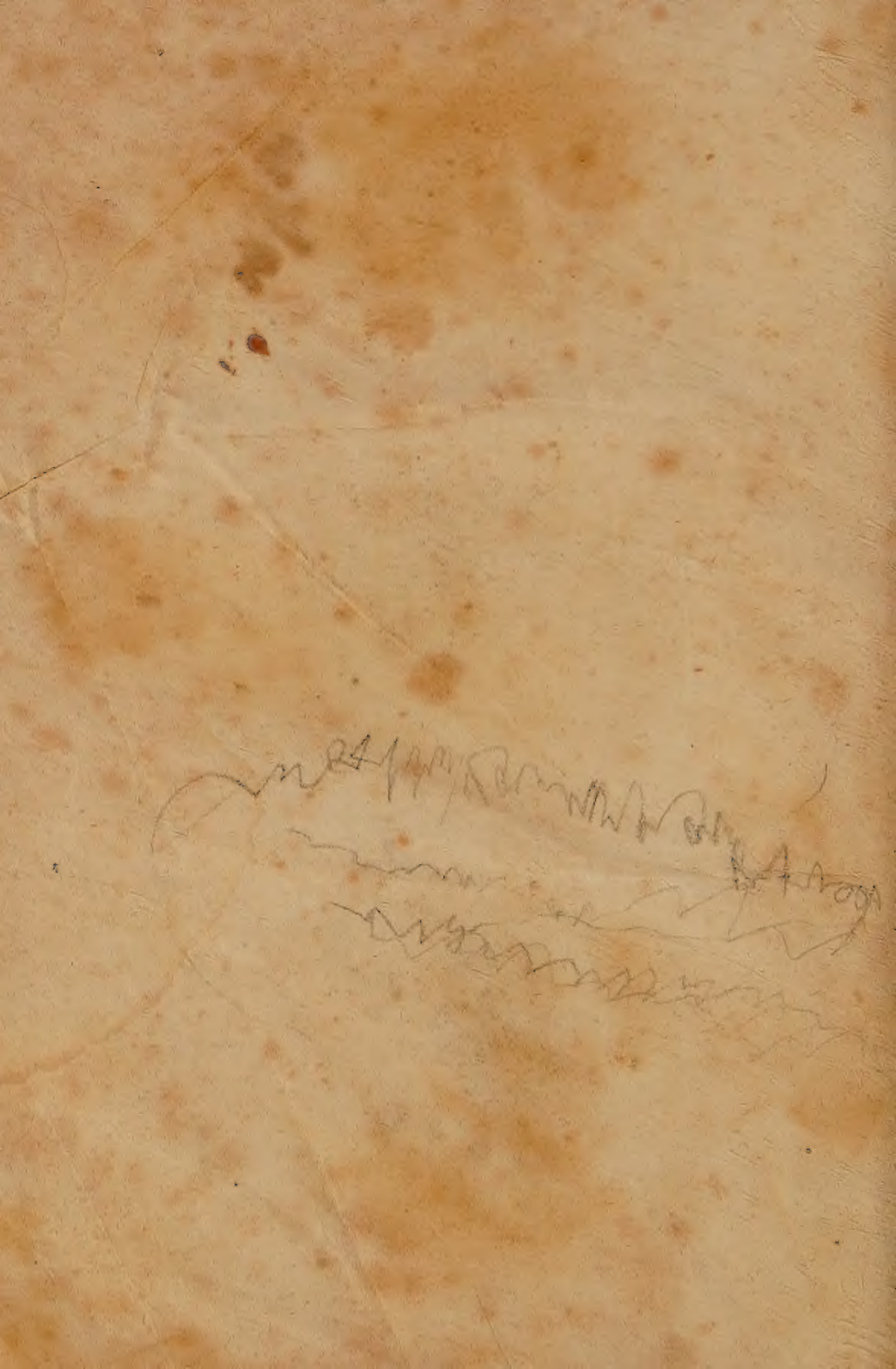

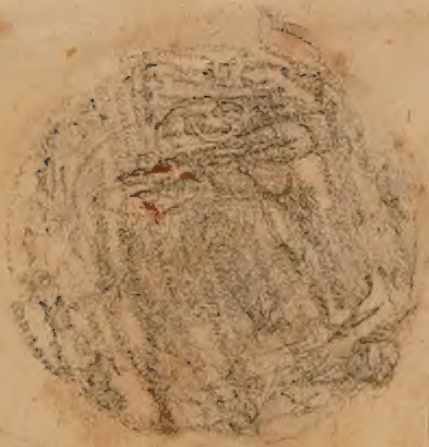

Henry Lothis Jones
Oak Hill

FARMERS' SCHOOL BOOK.

This book should be read in common schools in the place of the "English Reader," "Columbian Orator," and other similar works. By reading the Farmers' School Book, the children will learn the business of practical life; and this is much more desirable than to read the English Reader, a book they seldom understand, and one they can put to no practical use.

From the steam presses of
Packard & Van Benthuysen.

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FARMERS' SCHOOL BOOK.

PREPARED AND PUBLISHED BY

J. ORVILLE TAYLOR,

AUTHOR OF THE "DISTRICT SCHOOL," &c.

THIS WORK CONTAINS THE MOST IMPORTANT INFORMATION ON AGRICULTURE.

ALBANY:

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PREFACE.

CHILDREN may read and study in the school-room what they will practice when they become men. They now read the "English Reader," or some other "collection" that they do not understand, or feel any interest in; and which, the worst of all, never gives them one useful idea for the practical business of life.

This little work has been published to take the place of such useless, unintelligible reading. Its object is to give children, while they are receiving their school education, a scientific, practical knowledge of the labours of manhood. To the YOUNG FARMER the work is invaluable, and it will seize the feelings and get the attention of every child that is learning to read. The improvement of our schools, and the interests of Agriculture, have long been calling for such a work. It has now appeared, full of the most useful information, yet in a small, cheap form. The schools may obtain it without delay.

The introduction, and the part which relates to Chymistry, together with a portion of the chapters

on Cattle and the nature and properties of the Soil, it was necessary for me to write. I have been greatly assisted on the subject of Sheep Husbandry by Judge BUEL's invaluable periodical, the "Cultivator." That part which relates to the manufacture of Sugar from the Beet is taken from Pedder's Report—the best source of information we have. The chapter on Hemp was written by the Honourable Henry Clay of Kentucky. Much assistance has also been obtained from many of the first writers of the day on Agriculture, and particularly from an able English work, called the "Complete Grazier."

The work is emphatically a choice collection of the most important things which our best writers have said on the science and practice of Agriculture. A concise manual for farmers while engaged in their labours, and a large amount of the most useful information for children to read over and over again in their schools.

INTRODUCTION.

1. The King of Sparta being asked "what things he thought most proper for boys to learn," answered, "Those things which they expect to do when they are men." The young farmer has not taken this advice. He has learned nothing of his profession, while receiving his education. The study of Agriculture has not even been pursued in the district schools!

2. When a boy wishes to become a carpenter, or a shoemaker, or a blacksmith, he considers it necessary to study his business for seven or eight years. And if he chooses one of the professions—law, physic, or divinity—he devotes ten or twelve years to the study of those things which he expects to do when he becomes a man. If he desires to be a merchant, the different markets, products, and the wants of the people, the facilities of commerce, the value of exchanges, the supply and demand of articles, engross his attention, and all the powers of his mind, for months and years.

3. But knowledge is more important, more valuable to the farmer, than to the tradesman, or to the professional man. The farmer should understand Chymistry, that he may know and change the nature of the soils, that he may rightly prepare the

best manures, and wisely mix the different earths —and, also, that he may understand the way in which the plants take in their nourishment from the air and earth, and be prepared to assist them in this nice operation.

4. He should know something of GEOLOGY, that he may see the nature of the different soils, which are mostly made of pulverized rocks. By knowing the nature and location of the rocks in the neighbourhood, he can form a very correct opinion of the nature and properties of the soil, and judge how far the heavy rains or the droughts will affect the crops.

5. MINERALOGY should be studied to some extent. Plaster, lime, marl, &c. are discovered by means of this science. The properties of these *stimulating* manures, so valuable to the farmers, would never have been known or applied, if the study of mineralogy had been neglected. There are beds of plaster, marl, and lime, in almost every section of our country ; and if the farmers would give a little attention to this simple and delightful part of natural science, mines of wealth would open on many a barren corner of the farm.

6. MANURES are now but little studied or understood. They are so made, or so applied, that but little good, compared to what they might do, is derived from them. The moisture of the barnyard is permitted to soak into the earth, or to run off to uncultivated portions of the farm. Fermentation is either checked too soon, or goes much too far. And the manure is frequently left in the yard till all the nutritive gases have evaporated and become lost in the air.

7. Long, warm manures, which should be put on hard, cold soils, are often put on soils that are open and warm. Rotten, cold manures, containing nothing but a few salts, which should be used only on warm, light soils, are mixed with clayey, heavy lands: and a crop that requires a certain manure, is frequently dressed with one directly opposite in its character. There is not much knowledge of manures, and frequently less judgment in their application.

8. The rank weeds that grow under the fences, on the sides of the road, and among the crops in the field, together with the *potato tops*, might be gathered and thrown into heaps to ferment, and thus furnish to the farmer yearly a large quantity of the most valuable manure. Manure is the life of the farm, and the agriculturist should make all he can, and know how to apply it to the best purposes.

9. The GRASSES are a very important study. Only two or three of these, such as timothy and clover, are generally cultivated. That there are twenty or thirty different kinds well adapted to our soil, and that some of these are much larger and quicker in their growth, is known only to a few. The common grass is raised from year to year without seeking for anything better. But this is not considered *profitable* farming.

10. The different GRAINS are not always selected for their appropriate soils. Each grain has its own particular food, and the soil that is rich in nutriment for one kind may have nothing nourishing for another. It requires long observation, and much knowledge of the distinct individual food of the

grain we wish to raise, and of the existing properties of the soil we cultivate, to make a wise adaptation of grains to soils. A rotation of crops is always necessary, and much study is required to know the best rotation.

11. How often do farmers sow foul, imperfect seed! They not only show indifference to the most profitable grains, but they not unfrequently, because the trouble is somewhat less, sow seed of inferior growth, or that which is mixed with the seed of the most destructive and troublesome weeds. By using such seed, the farm soon becomes unfit for cultivation. Farmers also neglect to destroy the first growth of any foul weed. They permit it to go to seed, to spread its roots, and finally to take full possession of the soil, when one hour's work at first would save the farm.

12. The best breeds of CATTLE are not always selected. Although it costs as much to keep a small, light, bony breed of cattle, as it does to feed a square, meaty, heavy breed, yet most farmers still continue to raise the old, unprofitable stock, and appear indifferent to the advantages of the better breeds that have been introduced by observing, enterprising men. Farmers may receive double the profits from their cows and beef cattle, if they will only obtain the better, improved breeds.

13. SHEEP, if there is a good selection and proper care, may be made very profitable to the farmer. But their nature is so imperfectly understood, and their favourite, healthy food so seldom known, or procured, that their profits are greatly diminished by the yearly loss of the flock by death. It is surprising that men will continue to lose their sheep

from year to year, without paying any attention to their diseases and the remedies. The most profitable breed is not always procured. Habit and indolence still, in many places, continue to raise the English sheep, with its thin, long, coarse wool, and its large consuming carcass.

14. Swine, perhaps, receive the least of our attention. The long snout, the sharp back, the stilted bony legs, the maw that is always devouring, yet always squealing for more, are what we see in almost every part of the country. The short nose, the fat cheek, the broad back, and the small short leg, or in one word the Berkshire Hog, we seldom meet with. Farmers may save half their corn and have double the quantity of pork, if they will only take a little pains in bettering the breed of their hogs.

15. Roots, such as the parsnip, the carrot, and the rutabaga, should be raised for his cattle by every farmer. One acre of roots will give as much food as three acres of grass. The cattle likewise are kept in a much better condition on roots than on hay exclusively. By a little labour in raising roots the farmer may at least double the profits from his stock. It is unaccountable that turnips, carrots, &c., are not more generally cultivated for cattle!

16. The Beet Sugar is soon to become one of the most common and most profitable products of the farm. Every farmer can make his own sugar from the beet as easily as he can make cider from the apple. The process of raising the beet and that of making the sugar are described in this book. That which relates to this subject is taken from

"Pedder's Report," the latest and most authentic source of information on this interesting subject.

17. Silk is also becoming one of our articles of produce. The raising of the silkworm and the mulberry tree, and the manufacture of the raw silk, are briefly but fully discussed in this work. The necessary information on this subject is here given in a small space. Farmers should plant the mulberry seed without delay. The culture of silk is simple and very profitable.

18. Hemp is also a profitable crop for farmers. I have obtained for this work the best treatise on the growth and manufacture of hemp that has yet been published. It is from the pen of the Honourable Henry Clay of Kentucky. He has cultivated this crop largely, and speaks after long and close observation. The culture of hemp may be made profitable in this state. The culture of Hops is also very ably and freely described.

19. The best Architecture of farmhouses, of barns and other outhouses, should also be studied by the young agriculturist. Convenience, security, and protection of the stock, should be studied in the location and structure of the farm buildings. We often see the fences around the barn and the house thrown down by the cattle, and the whole stock allowed to roam in every direction, through the garden and over the grain and the meadows, during the whole feeding time of fall and spring.

20. And we often see the hog pen between the road and the house, and the barn on the other side of the road directly opposite to the house. These objects should be placed in the field directly back

of the dwelling. Why it is that some farmers will have the hog pen and the barnyard immediately under the windows and door of their dwelling I could never imagine! The cattle are permitted to run around the house, and in the dooryard, and bite off and tread down the young trees, and the pigs are permitted to trouble the kitchen door, and to upset the swill barrel, and to root up the garden! But I have never been able to tell why this was so.

21. There is much to learn and much to correct. No other man should be so observing—so familiar with nature, in all her silent and wonderful operations—so well acquainted with every department of natural science, as the FARMER. NATURE and the FARMER work together—for the same object—in the same workhouse—and with the same tools and materials. Nature is struggling with all her great energies to feed and bless the human race; and *to aid her* is the work of the farmer. But he will be a poor help, unless he understands her mode of operation.

22. At present how deficient is the farmer's education! He does not learn that which makes his profession profitable and honourable! Farming, in too many instances, is merely BLIND IMITATION!—thoughtless, unproductive toil—the slavish delving of the hands, without the delights or the aid of the intellect! This must be so when there is no science to guide; when, in their only education, the children learn nothing of their profession! Then let *that* be taught in the common school, which will make farming *delightful*, *honourable*, and *profitable*.

THE

FARMERS' SCHOOL BOOK,

CHAPTER I.

CHYMISTRY.—GENERAL PRINCIPLES.

1. Chymistry is the science which makes us acquainted with the elementary parts of bodies; and, also, with the manner in which these parts act upon each other. The object of chymistry, then, is to *find out* the *elementary parts* of substances or bodies—the *nature* of these constituent parts—the *laws* which unite and separate them, and the *results* of this union and separation.

2. Natural philosophy speaks of the size, weight, hardness, or softness of a body, of a loaf of bread for example, while chymistry finds out the ingredients in it—flour, water, salt, and yeast, which make the loaf.

3. Natural philosophy says that matter, among several other qualities, has *extension*, which means length, breadth, and thickness; *impenetrability*, which means, that no two particles can be in the same space at one time; and *divisibility*, meaning, that every piece of matter can be divided into

several smaller pieces. Chymistry shows what all bodies are made of, and how the elementary parts which compose them are put together.

4. Substance, or body, means any kind of matter, solid, fluid, or aeriform—anything we can see, taste, touch, or smell. A stone is a solid body, so is a piece of wood; water is a fluid body, and the air, vapours, and gases are aeriform bodies.

5. Substances are either simple or compound. A simple substance is one that cannot be reduced into anything more simple. There are fifty-three simple substances; only thirty-seven of them are used in the arts, or in agriculture.

6. A compound substance is one composed of two or more simple bodies. Water is a compound body, being composed of the two simple substances, oxygen and hydrogen. Almost all the objects we see are composed of several substances.

7. A compound body can be separated into its simple elements. Air is a compound body, and can be separated into oxygen and nitrogen—the two simple substances which compose it. Again, put oxygen and hydrogen together, and water is formed—a compound body being made out of these two simple ones.

8. There is a tendency in particles and masses of matter to approach each other. This is called attraction. It acts upon matter at great distances. The sun attracts the earth, the earth attracts the moon; and if we throw a stone into the air, the earth has such an attraction on the stone as to draw it down again to the ground. When anything falls, it is drawn to the earth by a force which we call the attraction of gravitation.

9. Particles of matter have another tendency to approach each other, called the attraction of cohesion. While gravitation acts upon bodies at great distances, cohesion acts only upon particles at insensible distances. Cohesion brings particles of matter *of the same kind* into seeming contact, and keeps them in that situation.

10. On some particles it acts with great force, and on others the action, if any, is not perceptible. On solids its force is intense; on liquids the force is weaker, and on the particles of air, and the gases, it apparently has no action. There is considerable cohesion in ice, less when changed into a liquid, and not any when changed into a vapour.

11. Take two bullets; cut a piece from each, so as to make a flat surface, put them together with some pressure, and they will stick to each other with great force. A piece of glass, when laid flatly upon another piece, coheres with considerable force. The cohesion of a stone is destroyed by pounding it into a powder, and the cohesion of a lump of sugar is destroyed by dropping it into water—the water having a stronger attraction for the sugar than the particles of sugar have for each other.

12. Heat destroys cohesion, as when ice, or wax, or lead is melted. It seems to be an opposing power to cohesion. The atoms of bodies would come into actual contact, if it were not for a force called repulsion. This force is supposed to be heat, and prevents the atoms from touching each other. The blacksmith, by infusing heat into a piece of iron, destroys, to a degree, its cohesion,

thus rendering it soft and pliable for his use. The hardness or softness of a body is in proportion to its cohesion.

13. When the attraction of cohesion is exerted suddenly, the particles unite indiscriminately, and form irregular masses. But when it resumes its force more slowly, the particles assume a perpendicular arrangement, and form masses of regular figures. This is termed *crystalization*, and the regular-figured masses are called *crystals*.

14. Chymical attraction, or, as it is more generally termed, *chymical affinity*, is exerted between the particles of *different kinds* of matter. Put water and oil into a tumbler and the oil will rise on the top, not mixing with the water; but drop a piece of pearlash into the tumbler, and the oil, water, and pearlash will immediately unite and form soap. The reason is, that the pearlash has a strong *chymical affinity* for both water and oil, and becomes a bond of union between them.

15. Besides the three species of attraction that have been mentioned, there are electric and magnetic attraction. Rub a piece of sealing wax with a cloth, and put it near a feather or a pile of fine sand, and the feather or the particles of sand will jump to the wax and stick to it. This is electric attraction. By drawing the hand over a cat in the dark, sparks of fire are elicited. This is also electric attraction. The needle is directed to the pole by magnetic attraction.

CHAPTER II.

CALORIC.

1. Caloric is a very thin, subtil fluid. It cannot be seen, and is known only by the sense of touch. It is the cause of all our feelings of warmth, or heat. Its particles repel each other; that is, they have a tendency to separate and fly off. It is imponderable, which means, it has no weight. A body is no heavier when it is hot, or what is the same thing, full of caloric, than when it is cold.

2. It is found in all substances: in ice, in stones, in wood, in metals, in water, and in air. Everything contains some caloric. A liquid contains more caloric than a solid, and the aeriform substances, such as air, vapour, and the gases, contain more caloric than the liquid substances. The more caloric a substance has, the less solid it is, except clay and a few other bodies.

3. The attraction of cohesion makes solids. Caloric, it will be remembered, is an opposing power to cohesion, and therefore makes liquids. Every solid substance on the earth might be changed into a liquid or vapour by infusing into it sufficient caloric. If we lay a piece of ice on the stove, the caloric soon changes it into water, and then into vapour.

4. Caloric is communicated from one body to another. If we put the hand on a hot body, caloric passes from it into the hand, and causes the

feeling of warmth; when we touch a body colder than the hand, the caloric goes from the hand into the body. Caloric desires to be in all bodies in an equal degree, and therefore goes from object to object, when bodies are brought together. If we throw a hot ball into a pail of water, the large quantity of caloric in the ball goes off immediately into the water, and in a short time the water and ball have an equal temperature.

5. Caloric passes through some bodies with great rapidity, while through other bodies it passes slowly. It goes speedily through an iron rod, so that we cannot touch the hand within a foot of the heated end; but it goes so slowly through glass that we can take hold of a glass rod within three inches of the melting end. Hence, some bodies are called good conductors of heat, or of caloric, and others bad conductors. Iron is a good conductor; glass, stones, wood, and charcoal are bad conductors.

6. If we take a piece of wire, and a pipe stem of equal length, and put a piece of wax on one end of each, and place the other ends in the fire, the wax on the wire will melt directly, while the wax on the pipe stem is no warmer than when first put there—the wire being a good, and the clay a bad conductor of heat. Among the metals, gold is the best conductor of heat, platinum next, silver next, copper next—then iron, zinc, tin, lead, marble, &c.

7. Silks, woollens, and furs are bad conductors of heat, and they are for this reason worn in winter, that we may retain the heat of the body as far as possible—the body being warmer in winter

than the surrounding air, it is wise to keep within us as much of our own caloric as we can. In summer we wish to let the heat of the body pass off, and should at this season wear those materials that are good conductors of heat, such as cotton, linen, &c.

8. Air is a bad conductor of caloric. On this account a thick blanket is not as warm as a quilt; air being between the two outside pieces and in the cotton. The more open or porous a body is, the less its conducting force. Animals living in cold regions are covered with fine furs which almost prevent the heat's escaping from the body; while those living in warm parts are covered with coarse, thin hair, offering no obstacle to the free escape of heat.

9. Bricks, being bad conductors of heat, are frequently heated and wrapped in a cloth, and used for keeping the feet warm in cold weather; but a heated piece of plank is still better, because wood does not lose caloric as easily as brick.

10. Black is a better conductor of heat than white. Heat is reflected by white but passes through black. Take a piece of black woollen cloth, and another of the same size and quality of white, and lay them upon the snow, when the sun is shining. In a few hours the black will be found to have sunk below the surface of the snow, while the white will remain on the surface. The black cloth lets the rays of caloric pass through it and melt the snow beneath, while the white reflects the caloric.

11. When we go into the sun in summer it is wise to wear a whitish dress—the white, turning

the rays of the sun away from us, will make the heat less oppressive. In winter by wearing black, the rays of the sun enter the clothing and give warmth to the person.

12. There are six sources of caloric: viz., the sun's rays, combustion, friction, the mixture of different substances, electricity, and galvanism. The sun is the great fountain of heat, and thus of life. Caloric comes from the sun at the rate of 200,000 miles in a second of time. It warms and thins the frozen juices of the plants in the spring, and causes the sap to circulate through the trunks and branches of the trees.

13. As there is caloric in every substance, whenever anything is burned, a separation of the simple elements takes place; the caloric is set at liberty and produces in us the sensation of heat. The caloric that was before hidden in the wood or coal has from decomposition become free and active.

14. When two hard bodies are brought together with great force, a portion of the hidden caloric is forced out. By striking a flint with a piece of steel, caloric enough is forced out to melt the bits of steel that are struck off, and this makes what we call a spark.

15. A freezing body gives off heat. Taking away the caloric (it has been said) makes a liquid a solid. Consequently when water becomes ice, a quantity of caloric goes off from the water. This accounts for the moderation of the weather during a snow storm. The caloric that is constantly escaping from the freezing vapour warms the atmosphere.

16. Melting produces cold. When snow and ice melt into water, they must have an additional quantity of caloric, which is taken directly from the atmosphere. Friction produces heat on the same principle as striking one hard body against another: viz., by forcing out the hidden caloric. Instances have occurred of whole forests' burning down, by first kindling from the violent friction of the dry branches against each other by the wind.

17. The most intense heat can be obtained from a galvanic apparatus: strong enough to melt iron as quick as fire melts snow. If a piece of charcoal is ignited by the fire from a galvanic battery, it burns with the greatest intensity, and makes a light so bright that the eye cannot look upon it.

18. When two substances are mixed, and the mixture takes a more solid form, heat is produced; for no substance can become more dense without giving off caloric. If we take a vial half full of water in the hand, and pour into it a little *oil of vitriol* (sulphuric acid) the hand will feel warm. The mixture by condensing gives out a portion of its caloric.

19. The mixture of some substances produces cold. If we put a table spoon full of epsom salts into a tumbler and then pour into the tumbler a little water, the tumbler will feel very cold. In this case the mixture has expanded and taken the caloric from the tumbler.

20. Caloric expands bodies. When it enters a substance, it removes the particles farther from each other. Hence it enlarges the size of bodies, which become less compact. In this, caloric acts in opposition to cohesion. If we measure a picce

of iron when it is cold and then heat it, we shall find by measuring again while hot that it has increased in length and thickness.

21. The pendulum of a clock is longer in warm than in cold weather; as clocks go slower in proportion as the pendulum is made longer, they are apt to go too fast in cold, and too slow in warm weather. We may lay it down, then, as a rule, that caloric expands all bodies; that the expansion of the same body increases with the quantity of caloric which enters it.

22. When the particles of a liquid are heated they expand and thus become lighter than those that are yet cold. Consequently the heated lighter particles ascend, and the cold particles descend. Thus when fire is put under a kettle containing any liquid, two currents immediately take place; the hot particles rising to the surface and the cold ones falling to the bottom, there to be heated, and then give place to others.

23. This will show the advantage of placing the fire directly under the kettle; otherwise the water in the lower part will not readily heat. When the water bubbles and throws off steam, it is heated to what is called the *boiling point*. This point is 212° on the thermometer.

24. The atmosphere rests, or presses upon everything on the earth at the rate of fifteen pounds on each square inch of surface. The water having this pressure on it, does not so easily bubble *up* and the steam does not *rise* so readily. If we boil water in a vacuum, that is, where there is no air, the degree of heat required is less than in the open air by 140°.

25. Water boils in a vacuum at a temperature of 72°. Hence the higher you rise above the surface of the earth, the less the pressure of the air and the more quickly water boils. Water boils sooner by having a lid over the kettle, and on the top of a hill with a less fire than it does in the valley.

26. Water cannot be made hotter than the boiling point—212°. At this point it flies off in the form of steam. If we could make a vessel strong enough to hold the steam, water could be heated red hot like a piece of iron. But the steam is so strong, and has such a desire to go off, that it would be difficult to confine it. It is the steam's desire to expand that gives the steam engine its power.

27. When children roast eggs they crack the shells slightly before they put them into the fire, to keep them from exploding, or bursting, as they usually call it. The egg bursts because the liquid in the shell expands with the heat; if there is a little crack in the shell the steam will find vent and do no injury; but if the vapour is confined the shell explodes with a loud noise, and the egg is scattered through the ashes.

28. So in the boiler of a steam engine, if there is a proper vent (called safety valve) the steam will do no injury; but if the vent is not good, and the force of the steam is stronger than the boiler, an explosion will take place as certainly as in the roasting of an egg.

29. Air is expanded by heating it. If a bladder containing air be tied tight at the neck and held to the fire, it will expand until it bursts If put

in a cold place, the bladder will contract; that is, become partly empty.

30. When a substance cools quickly we say its *radiating* power is great. By polishing a teapot or any metalic vessel, we lessen the radiating power of the vessel and increase its reflecting power. That is, a polished surface throws off the heat coming from another body better than a rough surface; but a rough teapot lets the water cool quicker than a bright pot.

31. It is wise, therefore, to have the vessels which we desire to keep hot water in always polished bright. When a body continues to give off more caloric than it receives, it will become colder than the objects around it. The earth is constantly giving off caloric. During the day the sun gives caloric to the earth, but in the night the earth gives away heat without receiving any; of course the earth becomes colder during the night than the air.

32. The moisture in the air, having some of its caloric taken away by the cooling earth, becomes water and falls to the ground—this is what we call dew. There is no dew when the night has been cloudy, for the clouds are good reflectors, and send the earth's caloric back again, and the ground does not cool.

33. A piece of bright tin is a very good reflector. When a stove is necessarily placed near a wall, at one side of the room, a piece of tin placed against the wall opposite the stove will reflect much of the heat out into the room, which otherwise would be absorbed by the wall or ceiling.

34. If we should line a room with tin much less

fire would be required, but the heat would not be so agreeable, and the dazzling surface would be unpleasant to the eyes.

35. When a fire is made in a stove or fireplace, the particles of air next to the stove become warm first; heat expands them, and being lighter than the cold particles, they rise up to give place to the particles from above, that have not been heated. This makes two currents of air—a cold current going towards the stove, and a warm current going from the stove—till the room is thoroughly warmed.

36. We have said that when a body takes in caloric it grows larger, and when it gives off caloric it becomes smaller. There is one substance which is an exception to this general rule. This is water; for when it freezes it must lose some of its caloric, yet it increases in bulk.

37. We can satisfy ourselves of this fact by letting a basin *full* of water freeze hard. When frozen the ice will rise considerably above the top of the basin. A housekeeper knows this fact to her sorrow when she finds her earthen pitchers and glass tumblers cracked by being suffered to stand full of water during a cold night.

38. This exception in the laws of nature shows the wise care our Creator takes of us. If water, like other bodies, should become less in size when frozen, the ice would sink as soon as formed. Then another layer of ice would form to sink in its turn, till the rivers and lakes had become one solid mass of ice. The fish must then all die.

39. The heat of summer would not melt so

much ice; and no ships could move through the water; and finally, all animal and vegetable life would be destroyed. But the Creator has made the ice lighter than a piece of water of equal size, and the ice floats on the top, preventing the frost's reaching down far from the surface. The thin sheet of ice soon melts in the spring, and all is free again.

CHAPTER III.

OXYGEN.

1. Oxygen gas is one of the simple substances, and forms part of almost every body we see. It is one of the principal elements of the atmosphere we breathe; the air being composed, almost entirely, of oxygen and nitrogen. About one quarter of the air is oxygen, and it enters into the composition of every animal and vegetable, and into many of the minerals.

2. Oxygen gas may be obtained in a separate form by several ways. The usual method is to separate it by heat from red lead, manganese, or saltpetre. By applying strong heat to either of these substances, the oxygen is disengaged, and goes off in a separate form by itself, and is caught in a vessel prepared to receive it.

3. Oxygen gas has neither colour, taste, nor smell. When suddenly and forcibly pressed, it emits light and heat. In its pure state it is always

in the form of a gas, but when it unites with solids it becomes a solid. It is combined with hydrogen to form water, and with carbon forming carbonic acid gas.

4. Oxygen is found in all kinds of rocks: hence, the earth, the ocean, and the air abound in it. Oxygen has a powerful attraction for most of the simple substances; and there is not one of them with which it may not be made to combine.

5. When bodies are united with it, they are said to be *oxydized*. The rusting of iron is occasioned by the iron's uniting with the oxygen in the air. Gold and silver do not rust much, that is, oxygen does not combine with them readily. Iron we know rusts *or oxydizes* soon, if left exposed to the air and moisture.

6. All substances capable of burning burn with far greater brilliancy in oxygen gas. A piece of wood having the least spark of fire on it bursts into flame the moment it is put into a jar of oxygen. Even iron and steel, not commonly classed among bodies that burn, undergo a rapid combustion in oxygen gas.

7. Now, if the air was wholly made of oxygen, everything would burn up. If we should put fire into a stove, the stove itself would burn. The blacksmith in heating his iron would see his hammer and anvil bursting into a flame.

8. But the all-wise Creator has put just enough of oxygen into the air to burn wood, oil, coal, &c.; but not so much as to render fire dangerous, under proper care. The whole world would burn up by increasing the quantity of oxygen a little.

9. Take all the oxygen out of the world and nothing would burn. Oxygen is, therefore, called the supporter of combustion. The oxygen in the air makes our candles and fuel burn. When they burn, their ingredients do indeed disappear, but they are not destroyed. Although these ingredients fly off in a gaseous form, and are commonly lost to us, still they can be collected and preserved.

10. When this is done with requisite care, it is found that the ingredients of the bodies that have been burned weigh more after than before combustion; and that the increase in weight is equal to the quantity of oxygen which has disappeared during the burning. Man cannot destroy matter—he can only change its form and appearance.

11. Combustion, or burning, is nothing more than the rapid union of oxygen gas with combustible matter. This rapid union is always attended with a disengagement of heat and light. Before oxygen will unite with combustible matter, the temperature of the materials you wish to burn must be considerably raised. This is done by putting fire, or caloric, on the wood, coal, or candle-wick.

12. Oxygen is not only necessary to combustion, it is also necessary to animal life. No animal can live in an atmosphere which does not contain a certain portion of oxygen; for an animal soon dies if confined in a portion of air from which the oxygen has been previously removed.

13. If we confine an animal in a vessel that is air tight, the animal will feel no inconvenience at first, but it will soon grow uneasy, breathe hard,

and shortly die. If the air in the vessel is now examined, it will be found to contain no oxygen. While the air had oxygen in it the animal did well enough, but as soon as its breathing had consumed all the oxygen the animal died.

14. The object of breathing is to purify the blood; and the oxygen in the air seems to be the purifying principle. As breathing destroys oxygen, the air in a room filled with people becomes bad, and unfitted for supporting life. Candles in such a room do not burn briskly, as there is a want of oxygen.

15. The people who died in the "Black Hole of Calcutta" soon consumed all the oxygen in that small place, and as fresh air could not enter, there was nothing left to support life. It is very necessary to have rooms, especially schoolrooms, well ventilated. The bad air should be permitted to pass off, and fresh air have a free circulation.

16. It is oxygen that turns things sour. Oxygen uniting with sweet cider makes vinegar. As the oxygen of the air goes into the cider it is wise to let the cask be only part full, and the bung be left out, that the air may touch as much of the liquid as possible. It is the oxygen that turns molasses, beer, maple sap, &c., sour. This effect of oxygen is called its acidifying effect—and makes all the acids and oxyds that we know of.

CHAPTER IV.

NITROGEN.

1. NITROGEN is one of the constituents of atmospheric air; oxygen and nitrogen being the two elements which make the air. Nitrogen is a gas without colour, taste, or smell, and does not support combustion or animal life.

2. It extinguishes all burning bodies that are immersed in it, and no animal can live in it. Nitrogen can be obtained in a separate state by taking the oxygen out of a quantity of air, which leaves the nitrogen alone by itself.

3. The oxygen can be taken out in this way: burn a piece of phosphorus in a jar, which must be turned bottom upward, with the open mouth resting on water; or, standing an inch or two in the water. The phosphorus burns while lying on the water, till all the oxygen in the jar is consumed. The water will then absorb the carbonic acid created by burning the phosphorus, leaving the nitrogen alone in the jar.

4. Nitrogen is much lighter than oxygen, and consequently than the air. In a crowded room where the oxygen has been taken out of the air by breathing, the nitrogen rises and remains near the ceiling. The upper part of a crowded room, therefore, should be avoided.

5. In a crowded room there is another bad gas,

which falls to the floor, and is destructive of life. This will be described hereafter.

Nitrogen is found in all *animals*, but only in a few vegetables.

CHAPTER V.

ATMOSPHERE.

1. The air is that very light fluid that surrounds us everywhere: we live in it, and could not exist without it. It extends forty-five miles above the earth. The attraction of gravitation keeps it to the surface of the earth, in the same manner that any moveable object is kept; it also revolves with the earth around the sun. The wind is nothing more than the air in motion.

2. The atmosphere is without colour, invisible, has neither taste nor smell, and unless in motion, is not perceived by the sense of touch. It is 831 times lighter than water; that is, a quart of air is 831 times lighter than a quart of water.

3. Its qualities are fluidity, expansibility, elasticity, and gravity. Its great fluidity arises from the absence of the attraction of cohesion. This attraction has little or no influence upon the particles of air.

4. Its elasticity is great, for 128 bottlefuls of air can be so compressed as to be put into one of the bottles. As soon as the pressure is taken off, the air springs out to its usual volume.

5. The air expands largely likewise. Heating it increases its size, or volume. If a bladder containing a small quantity of air be held to the fire, the swelling will be seen, occasioned by the expansion of the air within.

6. The weight or gravity of the air, it has been seen by comparing it with water, is small. Its lightness is wisely ordered, for if it was even as heavy as water, we should not be able to move through it with such rapidity.

7. Its oxygen, we have said, supports animal life, and makes all our fires burn, and its fluidity carries the vapours rising from the seas and lakes over the earth to give drink to the grass, the grain, the trees, and the plants.

8. If its particles did not move over each other so easily, the air would not be the great carrier of the clouds which supply water to the vegetable kingdom.

9. The lightness and elasticity of the air enable the birds to use their wings, and go from place to place with the fleetness almost of the aerial currents. From the great weight of the atmosphere, we are enabled to raise water from the well by means of the common pump.

10. The atmosphere presses very heavily on the water in the well. When the bucket in the pump is raised, it leaves the bottom part of the pump emptied of its air, and the atmosphere pressing on the surface of the well crowds the water up the empty pump.

11. The pressure of the atmosphere prevents water from evaporating too much; if the pressure was a little less we should not have any water on

the earth, for a small degree of heat would send the fluids up into the atmosphere. As it is, the degree of heat is admirably adapted to the amount of pressure. The weight of the air binds the water down as it were.

12. The whole weight of the atmosphere is thought to be, by philosophers, equal to the weight of a ball of lead sixty miles through—two thousand one hundred and sixty pounds pressure on every square foot of ground. The air presses in every direction: upward, downward, and sidewise. It is owing to this that we are not injured by the great weight of the atmosphere.

13. When I hold out my hand I feel no weight upon it, because the pressure under and above my hand is equal. It is pressed up as much as down; the elasticity or *spring* of the air pressing up.

14. Atmospheric air contains about one part in every thousand of carbonic acid gas. This gas when breathed by animals destroys life. It is much heavier than air, and is frequently found in old wells, pit holes, and low marshy places. It is created by breathing, and falls to the floor of the room. More will be said of it hereafter.

15. The air also contains water in the form of vapour, and a large quantity of gaseous particles, rising from various bodies exposed to the heat of the sun, and oxygen of the air. It is seen, that the air is a compound of a great number of substances, and that it is the great receptacle for everything too light to stay on the earth.

16. As there are many things that are constantly rising into it, we should do all that can be done to obtain air in as pure a state as possible. In the

schoolroom each pupil destroys the oxygen of about one gallon of air every minute.

17. The oxygen in the air, it will be remembered, is what supports animal life. And from the body of every pupil there is a constant escape of an impure matter, in the form of gas, going into the room and loading the air with disease.

18. The air thus unfitted for supporting life should be let off by ventilators in the ceiling, and not retained, as is too often the case, in the schoolroom, to give the pupils drowsiness, stupor, and disease.

CHAPTER VI.

CARBON.—CARBONIC ACID.*

1. Carbon is extensively diffused through nature, and is found in both the animal and vegetable kingdoms. Charcoal is nearly pure carbon; so is cotton; and the diamond is nothing but pure carbon crystalized. Lampblack and soot are also chiefly carbon.

2. Charcoal is formed by heating wood to a red heat, in a place where the air is not admitted. Usually, when charcoal is made, the wood is covered with earth, the whole forming what is called a "*coal pit*."

* The most of this chapter is taken from "Chymistry for Beginners."

3. If you burn wood in the open air, the whole, almost, will disappear in the form of vapour and carbonic acid gas; a small portion of ashes is the only thing left. But charcoal, which is almost all carbon, must not be confounded with the various kinds of coal that are dug out of the earth; these are called *mineral* coal. They, it is true, contain a large portion of carbon, but mixed with sulphur, pitch, and iron. They, consequently, are heavier than charcoal.

4. Charcoal is remarkable for its power of absorbing, or taking in gases of different kinds, and for letting them escape again when it is heated. When newly made, its pores are filled with the first kind of air or gas which comes in contact with it. To free its pores it must be heated, when it is again ready to absorb other gases.

5. Hence, charcoal will purify water that has become putrid, and for this reason is very useful to persons at sea, who cannot obtain fresh water. Tainted meat may be made sweet by being boiled with powdered charcoal, or rubbed thoroughly with it. But the housekeeper who uses it for this purpose must remember that it must be heated to redness, and applied to the meat before it has absorbed other gases than the putrid odour of the meat.

6. Charcoal in the form of lampblack is used with oil for paints and printer's ink; with iron, it forms steel; with sulphur and nitre, it makes gunpowder. It is in common use for fuel, and especially for cooking operations of various kinds. The *diamond* furnishes not only the most elegant

ornaments, but is useful in arts; and is the best substance known for cutting glass.

7. Carbonic acid gas (sometimes called *fixed air*) is found in limestone and magnesia, and may be driven out from these solid substances by heat. This gas is also formed by breathing, fermentation, and combustion.

8. No animal can live in this gas—they die almost immediately. It is different in its effects upon the lungs from nitrogen or hydrogen; *they* do not support life, carbonic acid gas *destroys* it. In the two former, animals die for the want of oxygen, in the latter they are killed. It is on account of the deadly nature of this gas that charcoal is so dangerous when burned in a close room.

9. The small portable furnaces which are now so much in use for cooking, ironing, and other household operations, should never be used except in the open air, or in a fireplace; and then the doors of the room should be opened. The charcoal, as it burns, gives off carbon, which, uniting with the oxygen of the air, forms carbonic acid gas.

10. This gas does not support combustion, and an animal cannot live in air which contains sufficient carbonic acid for extinguishing a lighted candle. Hence, the wisdom of letting down a burning candle into old wells, or pits, before any one ventures to descend. If the light goes out, the air is certainly impure, and there is generally no danger if the light continues to burn. As it is heavier than the atmosphere, it sinks into these low, excavated places.

11. This gas is called carbonic *acid*, because it gives to liquid substances an acid, or sour taste,

of a peculiar kind, which, though not sharp, is lively and refreshing. The agreeable pungency of beer, bottled cider, &c., is in a great measure owing to the presence of this gas ; by the loss of which, or exposure to the air, they become stale. It causes the sparkling and boiling up of soda water, and the liveliness of the Saratoga mineral waters.

12. The peculiar properties of yeast or emptyings are owing to this gas. In struggling to escape through the wet flour, or dough of which bread is made, the carbonic acid gas becomes entangled and causes the little cavities or holes which appear in light bread. Pearlash makes cake light on account of the carbonic acid gas which it contains.

13. We see that the effect of this gas on animal life is death, and we also see that this gas is produced in great abundance from the breathing of animals, decomposition or "*rotting*" of animals and vegetables, and the burning of candles and fires. Apparently, it would increase sufficiently in a short time to destroy all animal life.

14. But the wisdom of the Creator has made the plants of such a nature that they absorb this gas, and the atmosphere which is breathed by animals is purified by the vegetable kingdom.

15. Carbonic acid gas is food for plants, and they are nourished by what is given off by and destroys animals. Again, the life of animals is oxygen, and plants give off this gas in large abundance. How wisely are the two kingdoms related to each other! ! Truly, "In wisdom has He made them all."

CHAPTER VII.

LIGHT.—ELECTRICITY.

1. LIGHT has a very important action upon vegetation. Plants raised in dark places are nearly without colour, perfume, taste, or firmness of texture.

2. Whether the luminous fluid called light enters into the plants or not, it certainly has a wonderful influence on their combinations. Plants do not emit oxygen gas, excepting when exposed to the rays of the sun; and it is known, also, that flowers rarely produce fruit if raised entirely in the shade.

3. When electricity is abundantly diffused through the atmosphere, it has a powerful influence over vegetation. It excites the action of oxygen, and determines the condensation of the aqueous fluids. Grain germinates or sprouts quicker in water filled with electricity. And it is a well-known fact that fermentation takes place most rapidly during a thunder storm: at this time the air is full of electricity.

4. A liquid consisting of a variety of ingredients, not very closely united, milk for instance, is decomposed and becomes sour under a highly electric state of the air—dairy women know that their milk sours very rapidly during a thunder shower. It is the presence of a great quantity of electricity that produces this effect.

5. We have now mentioned the principal ingre-

dients and principles existing in the atmosphere, which have more or less influence upon plants and animals. The next thing to be considered is water.

6. When we reflect upon the influence which the atmosphere exercises over vegetation and over the principal operations carried on by farmers, we are astonished at not finding the simple instruments which tell its changes every moment.

7. There should be on every farm a hygrometer, to ascertain the moisture of the atmosphere; a thermometer, to indicate the degree of cold and heat; and a barometer, to determine the weight of the atmosphere. This last instrument would be very valuable, by foretelling the changes of the weather; the rising of the mercury announces the return of dry weather, and its sinking warns of rain and storms.

8. It is true that we can regard these variations only as signs; but they are signs much more certain than those which people derive from the screaming of tree toads and the changes of the moon. Expensive, complicated instruments are not wanted; but cheap, simple, yet determinate ones should always be had.

9. Judge Buel, in his invaluable paper, the Cultivator, has somewhere described these instruments, and given such directions as will enable farmers to obtain and use them.

CHAPTER VIII.

HYDROGEN.

1. Hydrogen is a gas, and one of the simple substances; it has neither colour, taste, nor smell. Hydrogen and oxygen united form water; and wherever water is found there is hydrogen. It is the lightest substance that we know of. It is found in vegetables and animals, and even in the rocks.

2. As hydrogen and oxygen form water, it follows that when the oxygen is taken from the water, the hydrogen is left in a separate form by itself. Hydrogen, then, can be procured in the following way.

3. Put a few bits of iron into a vessel, and pour upon them a little sulphuric acid, and four times as much water, and the hydrogen of the water will rise in a separate gaseous form, when it may be caught in a vessel prepared for the purpose.

4. The reason of the hydrogen's rising is this: The sulphuric acid aids the oxygen of the water in its strong desire to unite with the iron, which is soon done, leaving the hydrogen to rise, it being extremely light.

5. Hydrogen does not support animal life; for an animal soon perishes when confined in it. The hydrogen has no destructive quality in it, and death is occasioned, simply, by the want of oxygen.

6. Neither is hydrogen a supporter of combustion; for if we put a candle into it the light goes

out in an instant: yet hydrogen burns furiously when we put fire to it.

7. The blaze of a candle, or of a piece of wood or coal, is nothing but hydrogen and a little carbon burning—the oil, tallow, coal, and wood furnishing the hydrogen. The union of the oxygen in the air with the hydrogen and carbon in candles, wood, and coal, is always attended with heat and light, and makes what we call "fire."

8. If we put hydrogen and oxygen together and then set fire to the mixture, we shall have a loud explosion, and find that water has been formed. It appears a little strange that *water* can be formed by *burning* substances!! To produce this effect the mixture is two parts of hydrogen and one of oxygen.

9. The gas we burn in cities, for the purpose of lighting the streets, public buildings, &c., now used instead of candles and lamps, is principally the hydrogen gas. The companies who furnish this gas to the citizens make it from coal.

10. Coal, when exposed to heat in a closed vessel, is decomposed; and hydrogen, which is one of the ingredients of coal, rises in a state of gas, having a little carbon with it, forming a compound gas, called *hydro-carbonat*. This is the gas used to light cities, &c., and is transparent, invisible, and burns very readily and rapidly. This is a modern invention, and makes a great saving of oil and tallow.

11. In mines where they dig out coal, this *hydro-carbonat* gas is found in great quantities. This gas, when found there, is formed either by coal now burning far under ground, or was made

by a former combustion and kept in the caves and holes of the mine till the present time.

12. When the coaldiggers open the mine, the oxygen contained in the atmosphere mixes with this hydro-carbonat gas. Now we have said that when oxygen and hydrogen are mixed and then ignited, a deafening explosion takes place. If these miners take fire with them into the mine, they are liable to be blown up at any moment; for this hydro-carbonat gas, we know, takes fire with great readiness, and being mixed with oxygen will make a tremendous explosion.

13. As it is so far under ground, the people must have a lamp to see how to work, and explosions have very often happened which killed hundreds of men and horses. This combustible gas will collect there, the coal must be dug out, and the people must have a light to see how to work.

14. But explosions were constantly taking place, killing great numbers every time, till Sir Humphrey Davy—a great chymist—invented a lamp, called *safety lamp*, which gives the miners light but does not set fire to the gas.

15. This was a great invention, and has saved thousands of lives and made it safe for people to work in mines, that before no one would enter.

16. This *safety lamp* is nothing more than a common lamp, surrounded with a fine wire network, or gauze, which covering gives such a shape to the gas when it approaches the blaze that fire is not communicated to the body of gas outside of the network.

CHAPTER IX.

WATER.

1. WATER, as has been said, is a compound body, consisting of hydrogen and oxygen. It is found in four states; the purest of which is a solid, as that of ice. Increase the quantity of caloric in a cake of ice, and it becomes a liquid, and a still greater increase of caloric makes the liquid a vapour.

2. Water is also in a state of *composition* with other bodies, because in many cases it becomes one of their component parts; as constituting a part of the juices of animals and vegetables. Water contains atmospheric air, which is as necessary to the life of the fish as it is to animals that live on land.

3. The particles of air in the water pass over the gills (the lungs of a fish) and purify the blood. If we take the air out of a bottle of water and then put a fish into it, there will be almost immediate death. The more pure air the water contains the healthier it is; and hence we should not keep wells covered as close as many people do.

4. Water expands greatly when it changes into steam. The steam of one drop occupies as much room, or space, as 800 drops in a liquid state. At the poles the water always exists in a solid state. It is so hard there it can be cut with a chisel like marble.

5. Water falling through the atmosphere absorbs many impurities which float in the air, and thus purifies the element we breathe and live in. We say, "How sweet the air is after a shower."

6. Salt water is much heavier than fresh water; a vessel so loaded as to sink in fresh water would float in salt water.

7. "Water influences vegetation not only by the nutritive principles furnished to plants by its decomposition, but by means wholly physical, which we shall first consider. The first effect of water upon a soil appropriated to vegetation is, to moisten and divide the earth, and consequently to favour the extension of roots, the introduction of air, and the development of seeds.

8. "The second is that of conveying to the seed the first aliment required by it, oxygen, which that liquid always holds in solution in a greater or less degree, and which is, as I have already observed, the principal agent in germination. The third office performed by water is that of dividing the manure applied to the soil, of dissolving some portions of it, and conveying them to the organs of the plants in a state fitted for their digestion and nourishment.

9. "All kinds of water are not equally suitable for this purpose; rain water, which is the purest and contains the most air of any, is also the best for supplying the wants of plants. Generally speaking, those streams which have their rise in granitic or primitive calcareous mountains are favourable to vegetation; but it is necessary that they should flow through soils free from metallic salts, or earths; and that they should have traversed,

before being used in agriculture, a sufficient space to have become impregnated with a due portion of atmospheric air.

10. " Streams may not be pure, and yet may be very serviceable for watering the soil, especially if they carry, or hold in solution, certain salts favourable to plants, and some animal or vegetable substances. In this case they possess double virtue and produce double effect.

11. " Waters may be divided into three classes; the first comprehending those that are charged with animal matter; the second, those which hold in solution some of the principles of vegetables; and the third, the pure waters, or those which contain salts in but small quantities.

12. " The waters of the first class are the most active; and among them, those which are loaded with the sweat of wool, or with the ammoniacal combinations arising from the fermentation of powdered bones, of shavings of horn, or fragments of wool, hold the first rank. When employed in their dry state, as manures, these substances produce their effects very slowly, but exercise a much more energetic action when, during decomposition by putrefaction, their products are absorbed by water as fast as formed, and immediately conveyed to the plants. The soft, fleshy, or liquid portions of animal substance do not produce so lasting an effect; their decomposition is too rapid for their action to be continued for any length of time.

13. " The waters of the second class, those that are charged with some of the products of vegetation, either natural or arising from decomposition, form very good manures. When plants have

yielded to water all their soluble portions, the subsequent decomposition of their insoluble fibres furnishes new soluble products, which serve for nourishment; water imbibes these as fast as they are formed, and transmits them to the plants with which it comes in contact. In this manner dead plants supply food to the living, and all the elements composing the first are found differently combined in the last.

14. "When natural vegetable products, or those arising from decomposition, are mixed with, or dissolved in urine or the other animal fluids which are charged with salts, the effect upon vegetation is much increased, because, in addition to exciting the digestive organs of plants, these salts dissolve some substances which could not in their original state penetrate into these organs. It is for this reason that cakes of rape seed, wild mustard, and nuts, used in the manner mentioned above, afford the best manure known.

15. "The waters constituting the third class hold in solution some salts; these salts may be considered as performing several offices in the act of vegetation; they stimulate the vitality of plants, and increase the activity of their powers; they produce, in fact, upon plants the same effect as those produced upon the human body by the use of such condiments as marine salt and saltpetre. Salts of the same nature as those contained in waters of the third class, always produce good effects upon the soil to which they are applied, either by sprinkling the ground with them, or combining them with barnyard manure.

16. "Though these salts are useful to vegetation,

it is necessary to guard against using them in excessive portions; as they then dry up and destroy the plants. Lands which have been long overflowed by the sea refuse to yield anything to cultivation till they have, by the repeated action of fresh water been freed from the salt with which they had become impregnated.

17. "Some of the salts that are conveyed into plants by water exert an influence over them independent of their stimulating power; being decomposed within their organs, and serving, by the assimilation of their constituent principles, as nourishment to the plants. The greater part of the salts derived from the animal or vegetable kingdoms are of this description.

18. "Having considered water as a mechanical power, and as a vehicle for the conveyance of food to plants, it remains for me to make known its direct influence upon them. M. de Saussure has proved by experiment, that plants decompose water, and appropriate to their own uses the hydrogen and the oxygen contained in it; but this assimilation is very trifling, if they cannot at the same time absorb carbonic acid. The small increase of weight gained by a plant in an atmosphere containing only oxygen sufficiently verifies this.

19. "Dead plants which ferment when secluded from oxygen give out some carbonic acid; but this only proves the combination between the carbon and oxygen contained in vegetable products.

20. "Next to carbon, the most abundant principle in plants is hydrogen; which appears to be furnished, in a great measure, by their power of decomposing water. Hydrogen can be obtained

from plants by distillation, but in the decomposition of dead vegetables it unites either with the oxygen of the air to form water, or it is exhaled in union with carbon as carburetted hydrogen."—*Chaptal.*

CHAPTER X.

THE EARTHS.

1. "NEARLY all vegetables derive their support from the earth. As the earth furnishes the greatest number of plants, its influence upon vegetation is of the greatest consequence; yet this subject is one of the most difficult things of which we can treat.

2. "Plants are not, like animals, endowed with the power of moving about from place to place; but are always fixed to a limited portion of the soil. They depend upon the small space which they occupy for the supply of their wants. They can draw food only from those portions of the surrounding air, earth, and water that come next to them.

3. "It is necessary, then, that plants should find, immediately around them, the nourishing principles necessary for their growth. They should be able to extend their roots, in order to draw from the soil its nutritive juices; and to fasten themselves in the earth, so as to be secure from being dried up by heat, or uprooted by the winds. It

is important, then, that we examine the nature of earths, and the differences which exist among them."*

MOULD.

4. All plants, when dead, are more or less readily decomposed; that is, they separate into their original parts. This change is greatly hastened and helped by the air and heat. As dead plants are the principal food of living plants, it is very important for us to become acquainted with the products of vegetable decomposition.

5. This falling to pieces, or decomposition, of plants, is most rapid when they are collected in heaps. When large masses of vegetables are in a state of fermentation, heat is always produced; but if they have been dried, it is important to collect them into heaps, and moisten them slightly.

6. Sometimes the heat, in this case, is so great as to cause the heap to take fire; this occurs when hay is stacked without being sufficiently dry, or when rope, hemp, or flax is piled up wet. When all the parts of a plant are decomposed, there is left a substance of a brown colour, called *mould.* This mould contains salts, oils, and some of the earths.

7. The dying sod of a summer fallow is a mould; and, as has been said, this mould is produced by the fermentation of vegetable matter. Now, farmers frequently make a great mistake in what is called "*summer fallowing.*" When the sod is rotting, there is a constant escape of nourish-

* Chaptal's Agricultural Chymistry.

ing matter. The crop ought to have this escaping nutriment; therefore grain should always be growing while the sod is fermenting, or decomposing.

8. Land owes its fertility mostly, if not wholly, to the presence of ingredients found in mould, or to qualities similar to those in mould. These ingredients are furnished by manures, and by the decomposition of plants. But each crop takes away some of these ingredients, and a part is washed away by the rains.

9. Thus the soil is deprived by degrees of its nutritive qualities, till at length nothing remains but a few bare earths. These, being deprived of their nourishing juices, are completely barren. To restore its fertility, the land must be manured afresh, after having yielded several crops.

CHAPTER XI.

HOW TILLABLE LANDS ARE MADE.

1. ARABLE lands are made, almost entirely, by the decomposition of the rocks which form the basis of our globe. The water which flows in torrents from the tops of the mountains washes away their sides, till gravel, sand, and mineral slime are formed and deposited in the valleys below.

2. The number and size of the stones found in the valleys depend upon the distance of the mountains whence the stones were torn, upon the

harder or softer character of the rocks in the mountain, and upon the force of the currents of water which went from the hills to the valleys.

3. Nearly all our rich valleys were formed from the rocks in the mountains, and we can know the nature of the soils by examining the elevated lands and mountains in the vicinity. The deposites from mountains whose rocks are made up of quartz, feldspar, and mica, form soils mixed with silicia, alumine, lime, magnesia, and oxyd of iron.

4. It would, however, be wrong to suppose that the lands formed by the waste of mountains are, throughout, of the same nature as the rocks from which they have been produced. The heavier particles are dropped first, nearest the mountain, while the lighter elements, and those that have more affinity for water, are carried farther.

5. Rivers coming from different parts, and uniting, make deposites which form a soil, having very dissimilar ingredients. It frequently happens that this mixture of the mud of two rivers produces a soil more fertile than would be made by either of the rivers singly; the qualities of the one serving to correct the deficiencies of the other.

6. The soils found on the tops and sides of mountains must have been formed, after a lapse of many ages, by the constant action of the air, water, and heat. These powerful chymical agents soften and pulverize the rocky surface. Those rocks which have a strong affinity for air and water will necessarily fall to pieces before those that have less affinity.

7. As soon as the surface of the rock is furrowed and the mosses have fastened themselves upon

it, the plants that require but little nourishment take root and decay there in their turn. Each successive decay adds something to the top of the rock, till a soil is produced fit for cultivation.

8. Man, also, has not only changed the nature of soils, but he has made some of the most productive. By obtaining and mixing vegetable mould, minerals, clays, &c., he has made many a barren spot to blossom and yield an abundant harvest. If we would observe the ingredients which are found in our most fertile lands, we would be able, not only to improve our farms, but to make them larger.

9. Other causes than those we have mentioned have produced arable lands. The numerous lakes which have disappeared; the eruption of volcanoes; the overflowings of the seas; the bony remains of animals, and the decay of vegetables buried in the ground, have formed soils of all characters.

CHAPTER XII.

COMPOSITION OF ARABLE LANDS.

1. The best basis for good lands is a mixture of lime, silicia, and alumine. To make the best lands, these desirable qualities should be mixed in true proportions. Lands may have too much even of a good ingredient; in such cases some other necessary qualities are excluded.

2. We should find out the qualities of the rich and poor lands, that we may be able to correct the faults of the one by the qualities of the other, Every farmer knows when a field is worn out, and, also, when it is in what he calls "good order." But does he find out the absent qualities of the reduced land? Does he know the qualities he adds when he improves the poor land?

3. An excellent soil for wheat is of this character:—

	Parts.
Carbonate of lime	28
Silicia	32
Alumine	26
Animal or vegetable matter and moisture	11

4. In the best earths for tillage have been found the following qualities:—

	Parts.
Silicious gravel	32
Calcareous gravel	11
Silicia	10
Carbonate of lime	19
Alumine	21
Vegetable remains	7

5. In the best earths there is a large proportion of gravel. This renders the soil light and easily worked, and helps the passing off of heavy rains. Sandy soils are frequently too open, containing too much gravel. They should be mixed with clay, that they may *hold* the water. Clay lands hold the water too long, and should be mixed with sand that the water may more readily pass off.

CHAPTER XIII.

VEGETABLE NUTRIMENT.

1. The atmosphere, it has been seen, furnishes plants with two kinds of food. One of them is *carbonic acid* and the other oxygen. The air, also, carries in its bosom a large quantity of water, in the form of *vapour*. The coolness of the night makes this vapour fall to the earth, and produces what we call the dew.

2. The sun comes again in the morning and changes these drops of water into vapour, which will again at night fall on the plants. Thus the plants are moistened every twenty-four hours by the water in the air. Were it not for this, the heat of the sun would dry up the vegetable kingdom.

3. When water ascends from the earth, in the form of vapour, it carries along with it fine parts of decaying vegetables and animals. These putrid substances in the air are injurious to men and animals, but supply the best of food for plants. In order to have the most benefit from the dews, the soil should contain certain qualities which it does not always possess.

4. If the soil is dry and hard the dew does not enter into and moisten it. The dew in this case only moistens the leaves of the plants—the *roots* receive no benefit. It is necessary in this case to soften the earth, that the dews and rains may

reach the roots. For this reason we mellow the ground between the rows of corn, and other crops raised in rows.

5. Pulling up the weeds that stand in the hill loosens the earth next to the roots and stalks, and also prevents the corn from being choked. This little attention should always be given, as it enables the dew to fall directly on the roots of the plants.

6. It is highly important for us to ascertain the power the soil has of drawing in the dew from the air; and also the strength of the soil in retaining the dew. Every farmer may obtain this knowledge. He has only to dry thoroughly an equal quantity of two separate soils, and to weigh them night and morning for several days, and he can form an estimate of the quantity of moisture which each has drawn in during the night.

7. In this experiment he should spread each portion of earth over an equal quantity of surface. It is seen that the air and the earth are powerful agents in promoting vegetation. They act upon plants directly by their own principles; and they act as helps by conveying to the organs of plants such substances as are necessary for their support.

8. Although food is brought to the plants, it is heat alone that invigorates the organs, and enables them to take in the nutriment. So it is with many animals; they are benumbed by cold, and animated by heat. All soils do not receive and retain heat alike. Some are always wet and cold, others always dry and parched.

9. Cold, heavy lands are warmed by long manure, lime, &c.; while dry, hot soils are moistened and improved by clay, marl, and plaster. The manure from the sheep and horse is more heating in its action than that of cows.

CHAPTER XIV.

PROPERTIES OF MIXED EARTHS, AND THEIR CULTIVATION.

1. Soils should vary according to the nature of the plants to be cultivated in them. Some prefer a porous, dry, and arid soil; others flourish only in land constantly moist. There are some that require a great degree of heat, others vegetate in the midst of snows.

2. These peculiar tastes of plants ought to be known to the farmer: then he may select for each one the soil best adapted to it. Or, he may change the characters of those he possesses, so as to afford to each plant the soil most congenial to it.

3. For a plant to flourish in a soil, it is not enough that the earths composing it are of the right kind. It is necessary to unite other circumstances which are not always to be met with. For example, the arable soils which lie upon rocks vary considerably in depth. The thickness of this bed of soil not only exerts an influence upon the powers of vegetation, but determines the kind of plant which can be raised on it.

4. The bed of earth ought to be from ten to twelve inches in depth for grain, and much more than that for clover. For trees it must be much deeper than for grain or clover, or their roots, running to no depth, will extend their shoots to a great distance, and thus exhaust the strength of a large portion of soil.

5. It makes a great difference of what substance the substratum of the beds of earth is composed. If the substratum be of sand, the soil above will dry more quickly than if it were of marl or clay. A bed of clay under one of sand contributes to its fertility by retaining the water which easily filters through the last, and thus preserving its moisture.

6. But if the water collected upon the clay moisten too long a time the roots of the plants, they languish. Roots may be exposed to living, flowing water, without being injured by it; but stagnant water is always hurtful, and for the most part destructive to them. Hence, farmers should drain their fields and meadows. Draining, especially under draining, should be more attended to than it has been.

7. In lands that are too moist, it is good to form beds of pebble stones, upon which a layer of mould should be placed. Excellent meadows are made in this way, upon land which had never before produced anything but rushes. A clayey or marly soil resting upon a bed of porous rock is more fertile than one which rests upon a hard rock.

8. The reason of this is very simple. In the first case the water filters through the rock, and escapes; in the second, it remains stagnant, ren-

dering the soil pasty, and possessing none of the requisites for vegetation. Much of the land in this country is spoiled by letting the water stand on it till not only all vegetation is killed, but it is rendered wholly unfit for tillage.

9. Inclined lands, where the slope is rapid, and the soil light and open, are liable to have the manures carried off by the heavy rains. Even the soil is sometimes very much gullied. This frequently happens to lands cultivated upon the sides of mountains, till they become completely barren. Hence, we would conclude that it is unwise to clear up the sides of high hills, as much as is sometimes done. Furrows should never be left running up and down the hill, as this makes a channel for the water.

10. Thorough ploughing contributes largely to the fertility of lands. But in order that it may produce its best effects, it is necessary to have regard to some circumstances which are not generally attended to. Ploughing divides and softens the soil—mixes thoroughly its constituent principles—destroys weeds—and frees the ground from those insects which often abound in it.

11. The ploughings should be more numerous, and conducted with more care, upon a heavy soil than upon one that is light and porous. Clayed soils should be ploughed only when dry; when they have imbibed water they form a soft paste, which should not be worked. Sandy and calcareous lands may be ploughed at all times.

12. Deep ploughings are very advantageous to lands, which are of the same nature to a considerable depth. For those lower parts of the soil

which have become filled with the manures, that the rains have carried down below the surface, are thus thrown up, to contribute to the nourishment of vegetation.

13. Deep ploughings are also useful in those lands where the upper layer is too clayey and compact, and rests upon a bed of sand and carbonate of lime. By ploughing deep, the sand or lime is mixed with the clay above, rendering it more fertile than it could be made by any other means. An equally good result is obtained from deep ploughing in the opposite case, that is, when a soil, too sandy or calcareous, rests upon an argillaceous bed.

CHAPTER XV.

THE NATURE OF MANURES.—VARIETIES.

1. Whatever is drawn in by the organs of plants and contributes to their growth, may be called manure. The three kingdoms of nature furnish substances for manures. Those generally used are decomposed vegetables and some animal matters. Salts serve principally to stimulate plants; and hence, we have substances that may be called stimulants, and other substances that act directly as the nourishers of plants.

2. The nutritive manures contain parts which, when dissolved in water, are capable of entering into the roots, stalks, and leaves of the plants. It

is generally thought best to let these substances putrify or ferment; for this separates the parts, and makes them more easily dissolved in water.

3. When fermentation is taking place, the gases, such as carbonic acid, carburetted hydrogen, azote, and ammonia, are produced, and furnish food for plants. This will show the wisdom of having a crop growing while the sod is rotting, or, in other words, fermenting. And this shows summer fallowing to be a very bad practice; as in this case all the gases go off into the air without having any plants to feed.

4. Fermentation should not go too far in the barnyard or in the heap. If it does, there is nothing left but some fixed salts, mixed with those earths and juices which have resisted its action. It also permits the gases we have mentioned, which are the life of plants, to escape and waste in the air. Fermentation, to a great degree, should take place in the soil we wish to raise the grain from.

5. The very best kind of manure is usually lost in this country. In England and France the moisture from the stables is carefully conducted into reservoirs, made and placed for the purpose. The liquid is taken out of these vats, and thrown over straw, dry leaves, weeds, &c. In this way it is saved, and made to assist fermentation. In this country we either let it soak into the ground, or run off into useless, uncultivated places.

6. Many farmers heap up, in large piles, the collections of the barnyard, and allow them to rot uncovered and exposed to the changes of the weather. This is wrong. These heaps should

be covered by a slight roof of straw or boards, to protect them from the rain. Separate layers should be formed of each clearing of the stables, cowhouse, and sheep pens.

7. These layers should be from a foot and a half to two feet in thickness; and when the heat produced in them by fermentation rises in the centre to more than 95°, or when the mass begins to smoke, it should be turned to prevent decomposition from going too far. As the manure lies in yards, in heaps and thin layers, the fermentation is very unequal. Some parts have undergone too much decomposition and some not enough.

8. Fermentation should go on alike in the whole mass, and be arrested as soon as the straw begins to turn brown. To do this, the mass may be spread, or carried into the fields, to be immediately mixed with the soil. Or, we may mix with it mould, plaster, muck, straw, dry leaves, &c., while lying in the yard or in heaps.

9. There has been much said of late on the subject of fermentation. Some contending that the manure should be considerably rotted, and others that a very little fermentation is much better. Before deciding upon this question we should have reference to the soil to be manured. If this be compact, clayey, and cold, it is better that fermentation have taken place but slightly.

10. Unfermented manures soften and divide hard soils, and render them open to the air and water; and they also, while undergoing fermentation, lighten and warm the earth. But if the soil be light, warm, and porous, the fermented manure is preferable, because it gives out less heat, and

instead of opening the earth, already too open, it makes it more compact. Experience has made these facts known to all *observing* farmers.

11. When we wish to apply manure to any particular soil, we should ascertain the peculiar qualities of that soil, and then select the kind of manure adapted. Animals bearing wool furnish the warmest manures ; these may be mixed with the coldest soils. The next warmest is made by horses ; while that of cows and oxen contains the least heat of any. The latter is good for hot, sandy land.

12. Bones and horn scrapings have become in the hands of farmers powerful agents in fertilizing the soil. These parts of animals are principally composed of phosphate of lime and gelatine. Bones and horns should be ground or pounded fine, before mixing them with the soil. Farmers lose much by not attending to these parts of animals.

CHAPTER XVI.

THE NATURE OF MANURES.—CONTINUED.

1. The excrement of birds is another very valuable manure ; better than that of quadrupeds, for birds digest their food more thoroughly. It also contains more animal matter, and is richer in salts. This article is one of commerce between some of the isles of the Pacific and South Amer-

ica. Farmers in the United States neglect this manure entirely. The piles under the henroosts remain unseemly and useless from year to year.

2. Sir Humphrey Davy has proved by experiments that rye, wheat, barley, and oat straw have but two per cent. of manure in them. That is, only two pounds of manure in one hundred pounds of straw. The ninety-eight pounds consists entirely of fibre, which is a long time in decomposing.

3. In the whole vegetable kingdom, there is not a substance that affords so little aliment for plants or animals as the dry straw of grain. If it is thrown into the yard to soak up the moisture from the cattle, to mix with the excrement and to ferment, in this condition it increases largely the quantity of manure. In this way it should always be applied.

4. Weeds, leaves of trees, and all the succulent plants which grow so abundantly in ditches and waste lands, under fences, and by the roadside, *if cut when in flower, and slightly fermented*, furnish from twenty to twenty-five times more manure than straw does. These weeds and plants, carefully collected, furnish to the farmer an immense resource for enriching his lands.

5. If the farmer would cut these weeds for this purpose he would be a double gainer; for in this way he would prevent the foul seed from spreading over his land. It is surprising that agriculturists will let the foul plants go to seed, undisturbed, from year to year. The farm soon becomes full of poisonous plants, which choke the crops and draw up all the strength of the soil.

6. Farmers should make a small excavation, near a stream of water, and into this hole throw all the weeds, coarse grass, leaves, *potato tops*, &c., which may be gathered in summer. By letting a little water to this collection, the whole heap would soon ferment enough to make excellent manure. How much farmers lose by not attending to this one simple thing!!

7. There is another source of manure generally overlooked. The sides of the highway soon become covered with a rich sod, made by the litter of hogs, sheep, and cattle, which run in the road. This sod should every two or three years be carried into the fields and mixed with the soil. It would be a great addition to the manure made on the farm.

8. There is a species of manure called *compost*. This is made by arranging beds of different kinds of manure one above another, taking care to make such a mixture as is suited to the soil to be enriched by it. Suppose we wish to form a compost for a clayey, stiff soil.

9. The first bed must be made of plaster, gravel, or mortar rubbish; the second of the litter and excrements of horses, or sheep; the third of sweepings of yards, paths, barns, and of lean marl, dry and calcareous; of muck from swamps; the remains of hay, straw, &c.; and all this in its turn must be covered with a layer of the same materials as the first.

10. Fermentation will take place in the beds of dung, and the liquor flowing from these will mingle with the materials of the other layers. When the whole mass exhibits the signs of a high heat

and a brown colour, it must be carried into the fields. Care must be taken to mix well the substances composing the different layers.

11. If the compost be designed to manure a light, porous, and calcareous soil, it must be formed of materials of a very different character. In this case it is necessary that argillaceous principles should prevail.

12. The materials must be *compact*, the dung of the least heating kind, and the fermentation continued till the ingredients form a yielding and glutinous paste. The earths must be clayey, half baked and pounded, or consisting of fat and argillaceous marl and the mud from low places. Of these all the layers must be formed.

CHAPTER XVII.

STIMULATING MANURES—LIME, PLASTER, ASHES, AND MARL.

1. "LIME is familiarly known to farmers by the same name that is generally used by chymists. It is obtained by the aid of heat from rocks which go by the name of limestones. These are combinations of lime with carbonic acid, which is fixed in them by chymical attraction, but which, when driven off by heat, takes the same form as the air of the atmosphere, or becomes a gas. This gas from this circumstance has been called *fixed air*,

by which name it is often known as causing the sparkling and froth of cider and beer.

2. The principal part of limestone is therefore called by chymists *carbonate of lime.* Carbonate of lime is also found in shells, both those of living animals and those which exist in the ground in a fossil state. The former is mixed with animal matter, which is more or less separated from the latter, according to the time which has elapsed since the death of the shell fish.

3. Marl, in the sense in which the term is used by chymists, is a mixture of clay with carbonate of lime. The English writers on agriculture have not observed this distinction, and the term is sometimes applied by them to a decomposed chalk, which may contain little or no clay; and sometimes to the clay, which contains no carbonate of lime.

4. In fact, the name is frequently applied by them to any earthy matter found below the vegetable soil which is capable of increasing its fertility. From this misapprehension, the substances which go by the name of marl in New-Jersey, Maryland, and Virginia, do not correspond with the chymical definition, but are generally beds of fossil shells, mixed in various proportions with earthy and saline matters of various kinds.

5. Lime is a substance very different in its character from the two earths of which we have previously spoken. When prepared by heat from any of the original forms of its carbonate, it retains their shape unaltered, but may have its colour changed, and always loses considerable in weight.

6. It is now acrid, caustic, and corrosive, and

has some properties in common with potash, which are therefore alkaline. Of these the most important is, that it unites with acids to form compounds included in the general class of salts.

7. Of the salts of lime, which are important to the farmer, the three principal are : the *carbonate*, which, as we have stated, is found in limestone, chalk, shells, and marl; the *sulphate*, in which lime is combined with sulphuric acid, and which, in combination with water, is the substance so well known to our farmers under the name of plaster of Paris, or less familiarly by that of gypsum ; the *phosphate*, which constitutes a large part of the bones of animals..

8. Lime, when exposed to air, attracts carbonic acid, which is always to be found in the atmosphere ; it thus passes back to the state of carbonate, but in so doing gradually falls to powder, and is then said to be *air slacked*. If slacked with water, it also falls to a powder, which still retains the caustic character of the burnt lime ; but this powder, when exposed to the air, unites with carbonic acid more rapidly than when in mass.

9. Three principal modes of proceeding are in use for applying lime. The first is the most simple, and is the most general wherever lime is obtained cheaply, and where culture is but little advanced in perfection, and manual labour is dear. This is putting the lime [the burned limestone] immediately on the ground, in little heaps at twenty feet, average distance, and each heap containing, according to the rate of liming, from a cubic foot of the stone to half that quantity. When the lime has been slacked by exposure to the air, and

has fallen into powder, it is spread on the surface so as to be equally divided.

10. The second mode differs from the first in this respect: the heaps of stone are covered with a coat of earth, about six inches thick, according to the size of the heap, and this coat is equal to five or six times the bulk of the lime. When the lime begins to swell, by slacking, the cracks and openings in the heap are filled with earth: and when the lime is reduced to powder, each heap is worked over, so as to mix thoroughly the lime and the earth. If nothing hurries the labour, this last operation is repeated at the end of fifteen days—and then, after waiting two weeks more, the mixture is spread over the soil.

11. The third process, which is adopted where culture is more perfect and lime is dear, and which combines all the advantages of liming, without offering any of its inconveniences, consists in making compost heaps of lime and earth or mould. For this, there is first made a bed of earth, mould or turf, of a foot or thereabout in thickness. The clods are chopped down, and there is spread over a layer of unslacked lime, of a hectolitre for the twenty cubic feet, or a ton to the forty-five cubic feet of earth.

12. Upon this lime is placed another layer of earth, equal in thickness to the first; then a second layer of lime; and then the heap is finished by a third layer of earth. If the earth is moist, and the lime recently burned, eight or ten days will suffice to slack it completely. Then the heap is cut down and well mixed—and this operation is repeated afterward before using the manure, which

is delayed as long as possible, because the effect on the soil is increased with the age of the compost; and especially if it has been made with earth containing much vegetable mould.

13. This method is the one most used in Belgium and Flanders: it is becoming almost the exclusive practice in Normandy: it is the only practice, and followed with the greatest success, in La Sarthe. Lime in compost is never injurious to the soil. Light soils, sandy or gravelly, are not tired by repetitions of this compost. No country or author charges lime, used in this way, with having been injurious to the soil. In short, this seems the must sure, the most useful, and the least expensive mode of applying lime as manure.

14. Lime is the life of wheat, and should be used on land in this country more generally than it has been. We would recommend, to most farmers, the second method mentioned above, of applying it to the soil.

15. Plaster is profitably and extensively used in this country. On the sandy lands, the white or Nova Scotia plaster is thought best; but used on the loamy, clayey soils, the western plaster is supposed to be equally good, it not better. Plaster, or gypsum, as it is sometimes called, does not help low moist lands as much as it does dry uplands. On soil of the latter kind, it should be used more generally than it has hitherto been. It will well pay the expense and trouble.

16. Plaster was made known to us by Benjamin Franklin, upon his return from Paris. As Franklin wished the effects of this manure to strike the attention of all cultivators, he wrote in great let-

ters in a field of clover by the side of a public road, "This has been plastered." The rich vegetation which was seen in the plastered portion led him to adopt this method.

17. Volumes upon the excellences of plaster would not have produced so speedy an effect. From that period we have used great quantities of plaster.

18. Gypsum is a compound of sulphuric acid and lime, containing more or less water crystalized. A moderate heat deprives it of its water, and renders it of a darker colour. It can then be reduced to powder and employed in that state.

19. The gypsum should be scattered by hand, when the leaves and plants begin to cover the ground. It is best to do this during a light rain, as it is well to have the leaves a little moistened, that they may retain a small portion of the plaster. The effect of plaster is seen for three or four years. The use of it ought to be resumed at the end of that time, if not sooner. From three to four hundred pounds should be thrown upon an acre. When used on corn or potatoes it should be thrown into the hills.

20. Ashes produced by burning wood are excellent stimulants, though without being leached ashes are, usually, much too active. But after having been deprived, by the action of water, of nearly all their salts, they still produce great effects. In this state they are called *leached ashes*. How often do we see large piles of these ashes left, probably in the way, from year to year. If farmers knew their value, they would scatter them over the land without delay.

21. Leached ashes are most powerful upon low lands and meadows. Here they not only help the growth of good plants, but free the soil from weeds. By the use of these ashes, lands drenched with water may be freed from rushes, and prepared for yielding clover, and other plants of good kinds. They amend clayey soils and promote vegetation. Farmers should be careful to scatter them over the fields and not throw them into the dooryard from year to year, where they are entirely lost.

22. Marl is usually nothing more than a mixture of lime and clay. Shell marl is composed of lime and sand: this last kind is best for sand land, and the former for clay land. The shell marl is found in great quantities in New-Jersey, and has quadrupled the value of many farms. This is particularly the case in Monmouth county. There are also large beds of marl in the state of New-York, but little attention has as yet been given to this valuable species of manure.

CHAPTER XVIII.

IMPROVEMENT OF THE SOIL.

1. To improve the soil is to render it more suited to the growth of plants. Before this can be done we must know the particular aliment which the different plants require, and the present qualities of the soil we wish to act upon. We always work in the dark when we do not thoroughly and ac-

curately understand the *end* for which we are toiling, and the *substance* we are acting upon.

2. The soil can be increased by mechanical means. It is known that the best earths produce but little, if they be not stirred by the spade, the hoe, or the plough. This operation divides and softens the earth. It brings to the surface the manures of all kinds, which the rains had caused to sink below it. It helps the spreading of the roots and mixes the manure with the earth.

3. Ploughing also destroys weeds, and causes them to serve as manure. And, lastly, it frees the soil from vermin, which would otherwise multiply in it to the destruction of the harvest. Ploughing forms the basis of agriculture, for without it there can be no harvest. Ground that we are very particular with should be stirred with the hoe or spade, as these instruments are more thorough than the plough.

4. It is, in most cases, a good practice to harrow the fall grain in the spring. The drag, however, should be light, and the teeth made of wood. This operation opens the earth and lets in the air and moisture. The roller should be used on rough, open soils. This instrument is sometimes used on wet, heavy land with much injury. Reduced, clayey land will become too hard, without any assistance from the roller.

5. But on lumpy, porous land the roller should be used. It unites and levels the surface of the ground, and presses the seeds into contact with the earth. The roller also makes a fine preparation for the scythe. It is not unfrequently the case that the frosts of spring raise the roots of

grain out of the ground, when they are left bare, and soon die. By rolling the land at this time we crowd the roots again into the earth. This will often save a crop.

6. That the subject may be clearly understood, we will distinguish soils as clayey, calcareous, silicious, and sandy. These divisions seem to comprise all those requiring to be amended. And the quality of the earth we find in each will tell us what must be done to make an improvement.

7. A clayey soil is rendered pasty (what farmers call sticky) by rains, and it is hardened and cracked by heat. This soil absorbs moisture from the air only on its surface, but takes in the water from the rain so abundantly that the roots of plants are in danger, in a wet time, of being drowned. This great quantity of water also frequently stagnates; and this soon destroys the crop.

8. In clayey soils the freezing and thawing throw out the roots of the grain, and leave them exposed to the frost and winds. In this condition the grain *winter kills*. To remedy this, in part, we should pass the roller over the grain after every thaw. This will cover and crowd the roots of the grain into the earth.

9. Everything that will tend to soften this clayey earth, to render it more light and porous, and to hasten the passage of water through it, is adapted to the improvement of this kind of soil. We should mix with this earth calcareous sands, broken shells, chalks, lean marl, ashes, lime, &c. The ploughings should be deep and frequent. The green crops should be turned in. And there should be a plentiful use of the hot manures.

10. Calcareous soils possess properties entirely different from those of the clayey soils. The rains drain through them easily, and they throw off moisture readily by evaporation. The air, again, can penetrate the sandy soil and deposite the moisture with which it is charged.

11. The tillage of these soils is light and easy; and as they are loose and porous, provided they have sufficient depth, roots spread in them easily. To improve these soils we should make them capable of holding water, and this may be done by a dressing of fat marl or calcined clay. These soils, being naturally warm, require the fresh manure of neat cattle. The rich mud drawn from rivers and low places may be used with great success in improving calcareous soils.

12. The custom of allowing lands to rest after having produced several harvests, has long been in practice, and is still followed, to a great extent, in this country. It is thought that land ought to rest to recover its strength, or productive virtue. The necessity of rest in animals probably gave rise to this idea. But nothing is more unfounded in truth. If lands are properly managed they need not rest.

13. The scarcity of manure has been, again, another cause of letting lands lie fallow. But the ease with which fodder may be cultivated furnishes the means of supporting an increased number of animals, and hence of obtaining an increased quantity of manure. With the help of this the farmer need not let his lands lie idle. He may make sufficient manure to keep his land most of the time under the plough.

14. A great advantage has arisen from the system of rotation of crops, which is found to answer all the purposes of fallowing. By skilfully arranging a succession of crops of grain, artificial fodder, leguminous plants, roots, &c., the earth is enriched, instead of being impoverished. The ground is likewise cleansed from weeds, and more abundant crops are obtained at less expense.

15. During those years when certain fodders, such as clover and trefoil, require no other care than that of harvesting them, the farmer can bestow all his attention, manures, and the labour of his cattle upon such other portions of his farm as may need improvement. So that, instead of having one half of his land lying as an unproductive fallow, it may be covered with herbage, affording the finest food for cattle.

16. The soil will be growing richer, instead of poorer, and may be prepared for raising grain, without the addition of any barnyard manure. Farmers should keep sheep, not only for the profit on the wool, but for the purposes of manure. And they should make all the manure they can, from every plant that may grow upon the farm.

CHAPTER XIX.

SUCCESSION OF CROPS.

1. The soil and climate may be well adapted to the cultivation of a particular plant, and yet that plant not do well, if sown on the same piece

of ground from year to year. To manage land profitably, various kinds of vegetables must be raised on it in succession. The rotation must also be conducted with intelligence, that none unsuited to the soil or climate be introduced.

2. It is the art of varying the crops upon the same soil, of causing different vegetables to succeed one another, and of skilfully managing the effect of each upon the soil, which can alone establish that good order of succession which constitutes *cropping*.

3. A good system of cropping is the best surety of success that a farmer can have. Without this, all is vague, uncertain, and hazardous. To establish a good system of cropping, a degree of knowledge is necessary, which, unhappily, is wanting to the greater part of our practical farmers. Certain facts and principles, which may serve as guides in this important branch of agriculture, will now be stated.

4. *All plants exhaust the soil.* They take from it certain properties, which, if not replaced by art, will leave the soil so much impoverished. If crop after crop is taken from the same field, the ground will become fairly exhausted. The earth cannot give nutriment to plants without being impoverished.

5. *But all plants do not exhaust the soil equally.* Although the air, water, and moisture in the earth are the common food of plants, yet different plants have not the same aliment. Some love a dry soil, some a wet, while others will grow only in the richest lands. Every plant has its own favourite

food; and some are large, and others are small eaters.

6. The grains and most of the grasses having but few leaves, do not receive much food from the air or water, but obtain most of their nourishment from the ground. These, consequently, exhaust the soil more than such plants as have large, fleshy leaves, which feed upon the air and water, and draw carbonic acid and water into the earth. Nearly all the plants that are cut for fodder are of this kind.

7. In most cases those plants which are cut green, or while in flower, exhaust the soil but little: till this period they have derived their support almost entirely from the air and water. The stalks and roots are charged with juices, and those parts that are left in the earth after mowing will restore to the soil all that had been received from it by the plant.

8. *Plants of different kinds do not exhaust a soil in the same manner.* They exhaust only that portion of the soil which comes in contact with their roots. A plant that has a long, single root, may be able to find an abundance of food in land, the top of which has been impoverished by short spreading roots.

9. Plants of the same kind always send their roots in the same direction. They, consequently, are supported by the same layers of earth. A tree seldom prospers that has taken the place of another of the same kind. If there has been sufficient time since the old tree was taken away for its roots to rot and thus supply manure, the second

growth may flourish. But unless this is the case, the tree will not be healthy and thrifty.

10. It has been proved that plants have taste and choice regarding their food. It is in fact with them as with animals, there are some elements common to all, *and some peculiar to each kind.* This is beyond doubt, since a certain plant takes up one quality, and some other plant an opposite quality.

11. *All plants do not restore to the soil either the same quantity or the same quality of manure.* The grains take most from the soil and return least to it. Plants with large roots and stalks frequently return to the soil as much as they take from it. From what has been said, we may draw the following conclusions.

12. Although the soil may be well prepared, it cannot nourish a long succession of crops without becoming exhausted.

Each harvest impoverishes the soil to a certain extent, according to the degree of nourishment which it restores to the earth.

The cultivation of spindle roots ought to succeed that of top and running roots.

13. We should not return too soon to the cultivation of the same kinds of vegetables in the same soil.

It is very unwise to allow two kinds of plants which permit the ready growth of weeds to be raised in succession.

Plants that derive their principal support from the soil should not be sown, unless the soil is sufficiently provided with manure.

14. When the soil shows symptoms of exhaus-

tion, the cultivation of those plants that restore most to the soil must be resorted to. These principles are confirmed by experience.

15. We have here stated a system of agriculture, rich in its products, but more rich in its economy. *It saves labour and manure.* All cultivators ought to be governed by them. Their application, however, must be modified by the nature of soils and climates, and the particular wants of each locality.

CHAPTER XX.

GRASSES.

1. "I HAVE found in our publications on agriculture very little information on the improvement of our meadow and pasture grounds. Indeed, the names of our native grasses are scarcely enumerated, much less are their habits described, or their relative merits for hay and pasture pointed out, in any American work which has fallen within my notice. A considerable portion of our lands are unsuitable for the system of convertible husbandry, that is, an alteration of grain and grass crops.

2. "Of this description are our stiff clays, marshes, and swamps, and all of those lands in which tillage is rendered difficult by reason of hardpan, stones, or wetness. These should be improved as permanent meadows and pastures; and it is of

the first importance to the farmer to know the grasses which will render them most conducive to profit; for that our grass grounds are as susceptible of improvement as our tillage grounds, by a suitable selection of seeds and suitable management, must be apparent to every reflecting mind. The improvement and productiveness of our cattle and sheep husbandry, which at this time deservedly engage much of the public attention, depend materially on this branch of farming.

3. "*Sweet-scented Vernal Grass.* This is a grass of diminutive growth, and is not worth cultivating for hay. It is nevertheless considered as valuable in pasture, on account of its affording very early feed, and growing quick after being cropped. Its proper situation is *high*, well-drained meadows. It constitutes, in such meadows, in Massachusetts, at least one half of the whole crop. Its chief fault is that it is too early for the other grasses, but it affords a second and even a third crop if cut early. It is the grass which gives the finest flavour, so grateful to milch cows.

4. "*Meadow Foxtail* possesses all the advantages of early growth with the preceding, and is much more abundant in product and nutriment. It generally constitutes one of five or six kinds which are sowed together, by the English farmers, for pasture; and affords withal a tolerable crop of hay. It does best in moist soils, whether loams, clays, or reclaimed bogs. Sheep and horses have a better relish for it, says Sir G. Sinclair, than oxen.

5. "*Rough Cocksfoot.* Dr. Muhlenburgh and T. Cooper concur in opinion that this is the *orchard grass* of the United States, though some that I have

raised as orchard grass does not seem to correspond with the figure of the *dactylis glomerata* in the second volume of Dickson's Farmer's Companion. In England, cocksfoot is taking the place of rye grass with clovers. Arthur Young speaks in high commendation of it; though all writers concur in the opinion, that it should be frequently and closely cropped, either with the scythe or cattle, to reap the full benefit of its great merits.

6. "I should prefer it to almost every other grass; and cows are very fond of it. Cooper rates it above timothy, and says it is gradually taking the place of the latter, among the best farmers about Philadelphia. This is probably owing to the fact that it is earlier than timothy, and of course more suitable to cut with clover for hay. Its growth is early and rapid, after it has been cropped. It does well on loams and sands, and grows well in shade.

7. "If further facts are wanting in favour of this grass for pasture, the reader will find them in an article in the American Farmer of the fourteenth November, 1823, supposed to be Colonel Powel's, a gentleman who combines as much science with judicious practice, especially in cattle and grass husbandry, as any person in the Union. He says, 'I have tried orchard grass for ten years. It produces more pasturage than any artificial grass I have seen in America.' Sow two bushels of seed to an acre.

8. "*Tall Oat Grass.* Both Arator (Mr. Taylor) and Dr. Muhlenburg have placed this at the head of their lists of grasses, which they have recommended to the attention of the American farmer.

The latter says it is of all others the earliest and best grass for green fodder and hay. The doctor was, probably, not apprized of its deficiency in nutritive matter, as indicated in the table.

9. "It possesses the advantage of early, quick, and late growth, for which the cocksfoot is esteemed, tills well, and is admirably calculated for pasture grass. I measured some on the twentieth of June, when in blossom, when it should be cut for hay, and found it four and a half feet long. The latter math is nearly equal in weight, and superior in nutritious matter, to the seed crop.

10. "*Tall Fescue*, although a native grass, has not fallen under my personal observation. It stands highest, says Davy, according to the experiments of the Duke of Bedford, of any grass, properly so called, as to the quantity of nutritive matter afforded by the whole crop, when cut at the time of flowering; and meadow catstail (timothy) grass affords most food, if cut at the time when the seed is ripe.

11. "It grows naturally in wet grounds, in bog meadows, and on the sides of ditches, often to the height of four or five feet. Our ignorance of agricultural botany, and of the intrinsic value of this grass, can alone have prevented its being more generally known and cultivated. It must be very valuable for wet grounds, as from its rapid growth it is calculated to smother or keep down the coarser kinds, which naturally abound in these situations.

12. "*Rye Grass* is extensively cultivated in Scotland and the north of England, and where cocksfoot has not superseded it, is generally mixed

with clover seeds. It is rather declining in public estimation. It does well in pasture; and as it contains much nutriment, is considered valuable for cows and sheep. Dickson says it does best in rich moist meadows. Young does not speak well of it.

13. "*Red Clover.* There are many species of the *trifolium*, and several varieties of the red clover. Whether the kind we generally cultivate is the *pratense*, or not, I am unable to determine The character of red clover as a meliorating fertilizing crop, is too generally known to require illustration. It cannot be depended upon for permanent grass lands; though it yields to no grass for alternating with grain, in convertible husbandry.

14. "It formerly was as indispensable in a course of crops in Norfolk, England, (which has been considered pre-eminent for good tillage,) as turnips; and the maxim was, and still is, 'No turnips, no crops.' But it appears from Young's survey of that county, that it cannot now be depended on oftener than once in from eight to twelve years Trefoil, white clover, cocksfoot, rye grass, &c., are therefore alternated with red clover, in the grass years. There is reason to believe that neither red clover nor other grasses will bear repeating for a course of years upon the generality of the soils.

15. "They exhaust the ground of the peculiar nourishment required for their support. In Great Britain, white clover, trefoil, rye grass, or cocksfoot is generally sown with red clover seeds. From twenty to thirty pounds of seeds are sown to the acre In the northern states, timothy is generally

sown with clover; though the mixture is an improper one for hay; for the clover is fit for the scythe ten or fifteen days before the timothy has arrived to maturity. If sown alone, from eight to sixteen pounds of clover seed should be put on an acre; more on old land than on new.

16. "*White* or *Dutch Clover* (*trifolium repens*) is considered in England of importance to husbandry, if we are to judge from the great quantity of seed which is there sown annually. With us, many districts produce it spontaneously; but it is too seldom sown. It shrinks greatly in drying, and does not contain as much nutritive matter as red clover; yet its value as a pasture grass is universally admitted. Its increase is very much facilitated by a top dressing of gypsum, lime, or ashes.

17. "*Lucerne*, although affording much more green food, contains less nutriment in a single crop than red clover. It must, however, be borne in mind, that it grows much quicker than clover, and will bear cutting twice as often. In the soiling system, an acre of lucerne will keep four cattle or horses from the fifteenth of May to the first of October.

18. "I sowed seed in 1821, at the rate of six pounds the acre, with barley. It has stood the winters well, much better than clover; and has been in a state of progressive improvement. Drought has not affected it. The plants are very tender the first year, and require either a very clean tilth, or to be kept free from weeds and grass with a hoe the first year. It should have a deep loam, as it sends down tap roots five or six feet; and it

is equally necessary that the ground should not be wet.

19. "It may be sown either in drills or broadcast, with or without grain. Fifteen pounds of seed are required for the acre if drilled, and twenty are not too much if sown broadcast. To the proprietor of a dairy, an acre or two of lucerne would be valuable, to be fed to his cows in addition to ordinary pasture.

CHAPTER XXI.

GRASSES—CONTINUED.

1. "*Long-rooted clover* is a native of Hungary, and I do not think has ever found its way across the Atlantic. The root is biennial, and if sown in the fall, lasts only during the next season. It penetrates to a great depth in the ground, and consequently is but little affected by drought. It therefore requires a deep dry soil.

2. "The product of this grass, when compared to others that are allied to it in habit and place of growth, proves greatly superior. It affords twice the weight of grass, and more than double the nutritive matter that is given by the common clover. It gives abundance of seed; and, says G. Sinclair, if the ground be kept free of weeds, it sows itself, vegetates, and grows rapidly, without covering in, or any operation whatever.

3. "Four years it has propagated itself in this

manner on the space of ground which it now occupies, and from which this statement of its comparative value is made. This species would, no doubt, prove a valuable acquisition to our husbandry, whether we consider its value for green food, hay, or as a green crop to be turned in preparatory to grain.

4. "*Sain Foin* is peculiarly adapted to a calcareous or chalky soil. It is true it is cultivated in Norfolk, England, which is a soil of sand and loam, naturally destitute of calcareous matter. But it is common there to dress their lands with clay marl, which abounds with carbonate of lime; without which dressing, says Young, Norfolk soils will not grow sain foin.

5. "This writer considers it 'one of the most valuable plants that were ever introduced into the agriculture of Great Britain.' The well-known Mr. Coke cultivates four hundred acres of this grass, and sows it without other seeds. Several attempts have been made to cultivate sain foin in this country, but hitherto I believe without success.

6. "*Timothy.* This grass is distinguished in Great Britain by the name of *meadow catstail;* in New-England by that of *herd's grass.* It is one of the most valuable grasses that are cultivated; and what is worthy the notice of every farmer, it affords *more than double* the nutriment when cut in the seed that it does in the flower.

7. "In tenacious, strong, and moist soils it is entitled to a precedence, perhaps, over any single grass for hay, yet does not seem to be suitable to mix with clover seeds when intended for meadow. Another consideration, which renders it particu-

larly worthy of attention, is the seed which it affords, and which may be saved without materially diminishing the hay crop. From ten to thirty bushels of seed may be taken from an acre of timothy, which, at the price it now bears, is of itself a handsome remuneration.

8. "*Fiorin* has of late years been brought into notice in Great Britain, by the experiments of Dr. Richardson; who particularly recommended it for the cold boggy soils of the mountainous districts, where ordinary grasses would not thrive. The peculiar value of the fiorin, and of other grasses of the agrostis family, arises from their fitness for *winter pasture;* as they lose very little of their bulk or nutriment by remaining in the soil after they have ceased to grow.

9. "Its name (*creeping bent* or *couch grass*) implies a difficulty in mowing it, except on a surface perfectly smooth. We have seen it recommended to the notice of American farmers; but from the very limited progress which seems to have been made in its cultivation, we infer that it has fallen short of public expectation.

10. "*Upright Bent Grass.* Dr. Muhlenburgh considers this the *herd's grass* of the southern, and the foul meadow of the eastern states, of which *whitetop* and *redtop* are varieties. This grass is more congenial to our climate than to that of England. In any boggy soils, both varieties of this grass have come in spontaneously, as soon as the ground has been cleared and drained, have soon formed a compact sod, and afforded good hay and good pasture.

11. "*Flat-stalked Meadow Grass.* This, accord-

ing to Muhlenburgh, is the *blue grass*, which is considered as a pest in many of our tillage grounds. The small crop which it gives, and the little nutritive matter which this affords, show the little dependance that ought to be placed on it for grazing, or for hay.

12. "*Smooth-stalked Meadow Grass* is a native plant, and is well adapted for permanent pastures. It grows quickly after being cropped, and does well upon dry ground. *Floating Fescue* grows well in swamps and bog soils, where good kinds are most wanted.

13. "I would suggest, with much deference, whether grasses may not be divided, for the *practical* benefit of the farmer, into three kinds, to wit: 1st. *Cultivated grasses.* All kinds, strictly speaking, which the soil does not produce spontaneously, are cultivated grasses. But the term, as generally used, and as I here employ it, applies only to such as are sown to *alternate with grain, pulse, and roots, in a systematic rotation of crops.*

14. "The grasses selected for this purpose are, generally, the red clovers, lucerne, sain foin, orchard, timothy, tall oat, and rye grass. Clover is the primary dependance on all soils which will grow it, and especially where gypsum can exercise its magic powers. As vegetables are said to exhaust the soil in proportion to the smallness of their leaves, (the larger the leaves the more nutriment they draw from the atmosphere, and the less from the soil,) clovers are entitled to the high commendation they have obtained among American farmers. But as these plants are liable to premature destruction by the frosts of winter, it is

both prudent and wise to intermix with their seeds those of some other grasses more to be depended on.

15. " For this purpose, on sands, loams, and gravels, and these constitute the soils usually employed in convertible husbandry, the orchard grass and tall meadow oat grass appear to be best calculated to ensure profit. They grow early, delight in a clover sod, and are fit for the scythe when clover is in the bloom, the time when it ought to be cut. The hay from this mixture may be made before harvest commences ; and if the soil is good, a second crop may be cut almost equal to the first. If intended for pasture the second year, either of these grasses will afford more abundant food than timothy.

16. " *In clays*, the meadow foxtail, an excellent grass, might be substituted, though, according to Sinclair, the tall oat grass will do well here also. *In wet soils*, where clovers do not grow well, timothy and meadow reed grass would be a good selection, sown either separately or together.

17. " Lucerne and sain foin require a deep dry soil, and are generally sown without other seeds. The first does not attain to perfection before the third year ; and both, where succesfully cultivated, are permitted to occupy the ground from six to eight years.

18. " 2d. *Meadow grasses.* In selecting these the object is to obtain the greatest burden of good hay, and to mix those kinds which may be profitably cut at the same time. *For clayey and moist soils*, many valuable and nutritious kinds seem to be well adapted ; that is to say, meadow foxtail, timothy, tall oat, meadow soft grass, floating fes-

cue, rye grass, reed meadow, smooth-stalked meadow, American cocksfoot, upright bent or herd's grass, and tall fescue.

19. "And the last five are peculiarly suited to swamp or *bog soils*. For *dry loams*, *sands*, *and gravels*, which never ought to be kept long in grass, the cocksfoot or orchard grass and tall oat are probably the best; and to these might be added red and white clover. The great difficulty is to prevent the deterioration of meadows. This takes place from the better grasses running out, and giving place to coarser kinds, in moss, and to useless or noxious plants, aided often by a neglect to keep them well drained.

20. "The finer and more nutritious kinds thrive best in *moist*, though they will not live long in *wet* soils. Hence it is of the first importance to keep the surface soil free from standing water, by good and sufficient ditches; and it often becomes necessary, and in most cases it is advisable, on a flat surface, to lay the land in ridges at right angles with the drains.

21. "Another precaution to be observed is not to feed them with stock when the soil is wet and poachy. Harrowing in the fall has been found beneficial to meadows. It destroys mosses, and covers the seeds of grasses which have fallen, or may be sown, and thus produces a continued succession of young plants. In Europe, lime is used with good effect as a top dressing to grass lands, as are also ashes.

22. "With us, the annual application of a bushel of gypsum to the acre is found beneficial. It not only thickens the verdure with clover, but is of

advantage in most other grasses. Stable manure should be used only when it can be spared from the more profitable uses of tillage. When the means above enumerated fail to ensure a good crop of hay, it is time to resort to the plough, and a course of crops.

23. "3d. *Pasture grasses.* But few of the grasses most valued in Great Britain for pasture are the natural growth of the United States; but it is believed that if the seeds are once introduced upon our farms we shall find little difficulty in naturalizing them. Neither the orchard nor vernal grass, which are said to be indigenous to our country, is recognised in the grass lands which have come within my observation: yet they constitute, with foxtail and tall oat grass, the earliest and most valuable varieties for perennial pastures.

24. "The meadow foxtail and orchard grass, together with our white clover and green meadow grass, *poa trivialis*, (which seldom require to be sown,) I think would form the best selection for all grounds which are moderately dry. The rye and oat grasses, or meadow soft grass, might be either substituted for the first two or combined with them.

25. "These would afford spring, summer, and fall feed, abundant in quantity, and wholesome and nutritious in quality. On wet soils, (though pastures require to be drained, as well as meadows, to ensure a rich herbage,) the tall fescue, smooth-stalked meadow, upright bent, and herd's grass, may be introduced to advantage. Gypsum is applied to pastures with the same benefit that it is to meadows."—*Judge Buel.*

CHAPTER XXII.

HEMP.

1. "The preparation of the ground for sowing the seed is by the plough and horses, until the clods are sufficiently pulverized or dissolved, and the surface of the field is rendered even and smooth. It should be as carefully prepared as if it were for flax. This most important point, too often neglected, cannot be attended to too much. Scarcely any other crop better rewards diligence and careful husbandry. Fall or winter ploughing is practised with advantage; it is indispensable in old meadows, or old pasture grounds, intended for producing hemp.

2. "Plants for seed are ordinarily reared in a place distinct from that in which they are cultivated for the lint. In this respect, the usage is different from that which is understood to prevail in Europe. The seeds which are intended to reproduce seeds for the crop of the next year are sowed in drills about four feet apart. When they are grown sufficiently to distinguish between the male and female stalks, the former are pulled and thrown away, and the latter are thinned, leaving the stalks separated seven or eight inches from each other.

3. "After the seeds are thrashed out, it is advisable to spread them on a floor, to cure properly and prevent their rotting, before they are finally put away for use the next spring. Seeds are not

generally used unless they were secured the fall previous to their being sown, as it is believed they will not vegetate if older; but it has been ascertained that when they are properly cured and kept dry, they will come up after the first year. It is important to prevent them from heating, which destroys the vegetating property, and for that purpose they should be thinly spread on a sheltered floor.

4. "The seeds, whether to reproduce seeds only, or the lint, are sowed about the same time. Opinions vary as to the best period. It depends a good deal upon the season. The plant is very tender when it first shoots up, and is affected by frost. Some have sowed as early as the first of April; but it is generally agreed, that all the month of May, and about the tenth of it especially, is the most favourable time.

5. "When the object is to make a crop of hemp, the seeds are thrown broadcast. The usual quantity is a bushel and a half to the acre; but here again the farmers differ, some using two bushels, or even two and a half.

6. "The ground can only sustain and nourish a certain quantity of plants; and if that limit be passed, the surplus will be smothered in the growth. When the seeds are sown, they are ploughed or harrowed in; ploughing is best in old ground, as it avoids the injurious effect of a beating rain, and the consequent baking of the earth. It would be also beneficial subsequently to roll the ground with a heavy roller.

7. "After the seeds are sown, the labours of the cultivator are suspended, until the plants are ripe,

and in a state to be gathered; everything in the intermediate time being left to the operations of nature. If the season be favourable until the plants are sufficiently high to shade the ground, (which they will do in a few weeks, at six or eight inches' height,) there is strong probability of a good crop. When they attain that height, but few articles sustain the effect of bad seasons better than hemp.

8. "The maturity of the plant is determined by the evaporation of the farina, already noticed, and the leaves of the plant exhibiting a yellowish hue: it is then generally supposed to be ripe, but it is safest to wait a few days longer. Very little attentive observation will enable any one to judge when it is fully ripe. In that respect it is a very accommodating crop, for if gathered a little too soon the lint is not materially injured, and it will wait the leisure of the farmer some ten days or a fortnight after it is entirely ripe.

9. "Two modes of gathering the plants are practised, one by pulling them up by the roots, an easy operation with an able-bodied man, and the other by cutting them about two inches (the nearer the better) above the surface of the ground. Each mode has its partisans, and I have pursued both.

10. "When pulled, it is done by the hand, which is better for the protection of an old leather glove. The labourer catches twenty or thirty plants together, with both hands, and by a sudden jerk draws them without much difficulty. The operation of cutting is performed with a knife, often made out of an old scythe, resembling a sickle, not so long, but broader. The knife is applied

much in the same way as the sickle, except that the labourer stoops more.

11. "Whether pulled or cut, the plants are carefully laid on the ground, the evener the better, to cure; which they do in two or three days, in dry weather. A light rain falling on them while lying down is thought by some to be beneficial, inasmuch as the leaves, of which they should be deprived, may be more easily shaken off or detached. When cured, the plants are set up in the field in which they were produced, in shocks of convenient size, the roots or butt ends resting on the ground, and the tops united above by a band made of the plants themselves.

12. "Previous to putting them up in shocks, most cultivators tie the plants in small hand bundles, of such a size that each can be conveniently held in one hand. Before the shocks are formed, the leaves of the plants should be rapidly knocked off with a rough paddle or hooked stick. Some suffer the plants to remain in these shocks until they are spread down to be rotted. Others, again, collect the shocks together as soon as they can command leisure, (and it is clearly best,) and form them into stacks.

13. "A few farmers permit these stacks to remain over a whole year, before the plants are exposed to be rotted. I have frequently done it with advantage, and have at this time two crops in stalks. By remaining that period in stalks, the plants go through a sweat, or some other process, that improves very much the appearance, and, I believe, the quality of the lint; and this improve-

ment fully compensates the loss of time in bringing it to market.

14. "The method of rotting is that which is generally practised in Kentucky. The lint so spread is not so good for many purposes, and especially for rigging and ships, as when the plants have been rotted by immersion in water, or, as it is generally termed, water rotted.

15. "The greater value, and consequently higher price of the article prepared in the latter way, have induced more and more of our farmers every year to adopt it; and if that prejudice were subdued, which every American production unfortunately encounters when it is first introduced and comes in contact with a rival European commodity, I think it probable that in a few years we should be able to dispense altogether with foreign hemp.

16. "The obstacles which prevent the general practice of water rotting are, the want of water at the best season for the operation, which is the month of September; a repugnance to the change of an old habit; and a persuasion, which has some foundation, that handling the plants after their submersion in water during that month is injurious to health. The first and last of these obstacles would be removed by water rotting early in the winter, or in the spring.

17. "The only difference in the operation, performed at those seasons and in the month of September, would be, that the plants would have to remain longer in soak before they were sufficiently rotted.

18. "The plants are usually spread down to be

dew rotted from the middle of October to the middle of December. A farmer who has a large crop on hand puts them down at different times, for his convenience in handling and dressing them. Autumnal rotting is more apt to give the lint a dark and unsightly colour than winter rotting. The best ground to expose the plants upon is meadow or grass land, but they are not unfrequently spread over the same field on which they grow.

19. "The length of time they ought to remain exposed, depends upon the degree of moisture and the temperature of the weather that prevail. In a very wet and warm spell five or six weeks may be long enough. Whether they have been sufficiently rotted or not is determined by experiment. A handful is taken and broken by the hand or applied to the brake, when it can be easily ascertained, by the facility with which the lint can be detached from the stalk, if it be properly rotted.

20. "If the plants remain on the ground too long, the fibres lose some of their strength, though a few days longer than necessary, in cold weather, will not do any injury. If they are taken up too soon, that is, before the lint can be easily separated from the woody part of the stalk, it is harsh, and the process of breaking is difficult and troublesome. Snow rotting, that is, when the plants, being spread out, remain long enough to rot, (which, however, requires a greater length of time,) bleaches the lint, improves the quality, and makes it nearly as valuable as if it had been water rotted.

21. "After the operation of rotting is performed, the plants are again collected together, put in shocks or stacks, or, which is still better, put under

a shed or some covering. When it is designed to break and dress them immediately, they are frequently set up against some neighbouring fence. The best period for breaking and dressing is in the months of February and March, and the best sort of weather, frosty nights and clear thawing days. The brake cannot be used advantageously in wet or moist weather.

22. "It is almost invariably used in this state out of doors, and without any cover; and to assist its operation, the labourer often makes a large fire near it, which serves the double purpose of drying the plants and warming himself. It could not be used in damp weather in a house without a kiln or some other means of drying the stalks.

23. "The brake in general use is the same hand brake which was originally introduced and has been always employed here, resembling, though longer than the common flax brake. It is so well known as to render a particular description of it perhaps unnecessary. It is a rough contrivance, set upon four legs, about two and a half feet high. The brake consists of two jaws with slits on each, the lower jaw fixed and immoveable, and the upper one moveable, so that it may be lifted up by means of a handle inserted into a head or block at the front end of it.

24. "The lower jaw has three slats or teeth, made of tough white oak, and the upper two, arranged approaching to about two inches in front, and in such manner that the slats of the upper jaw play between those of the lower. These slats are about six or seven feet in length, six inches in depth, and about two inches in thickness in their

lower edges; they are placed edgewise, rounded a little on the upper edges, which are sharper than those below.

25. "An ingenious and enterprising gentleman in the neighbourhood of Lexington has been, ever since the erection of the above-mentioned machine, trying various experiments, by altering and improving it, to produce one more perfect, which might be beneficially employed on rotted hemp, to diminish the labours of the brake. He mentioned the other day that all of them had failed; that he had returned to the old hand brake, and that he was convinced that it answered the purpose better than any substitute with which he was acquainted.

26. "The quantity of nett hemp produced to the acre is from six hundred to one thousand weight, varying according to the fertility and preparation of the soil and the state of the season. It is said that the quantity which any field will produce may be anticipated by the average height of the plants throughout the field. Thus if the plants will average eight feet in height, the acre will yield eight hundred weight of hemp; each foot in height corresponding to a hundred weight of the lint.

27. "Hemp exhausts the soil slowly, if at all. An old and successful cultivator told me that he had taken thirteen or fourteen successive crops from the same field, and that the last was the best. That was probably, however, owing to a concurrence of favourable circumstances. Nothing cleanses and prepares the earth better for other crops (especially for small grain or grasses) than hemp. It eradicates all weeds, and when it is

taken off, leaves the field not only clean, but smooth and even.

28. "The rich lands of Ohio, Indiana, and Illinois are, I have no doubt, generally well adapted to the cultivation of this valuable plant; and those states enjoy some advantages for the cultivation of it which this does not possess. Their streams do not dry up as much as ours, and they can consequently employ better than we can the agency of water in the preparation of it.

29. "Their projected canals, when completed, will admit of its being carried to the Atlantic capitals at less expense in the transportation than we must incur in sending it. On the other hand, the unfortunate state of slavery among us gives us, at present, probably a more certain command of labour than those states have."—*Henry Clay.*

CHAPTER XXIII.

HOPS.

1. "The hop is a native plant. It is found growing spontaneously on the banks and intervals of many of our large rivers. There are several distinct species, all bearing a near affinity to each other—(I have noticed five.) At present they are cultivated together, promiscuously; no preference having been given to any particular one of them by the brewer. But I am of the opinion that there is

an essential difference in their qualities; that one may be the best for pale ale, another for strong beer, and a third for porter; and I presume, ere long, particular attention will be paid to ascertain their different qualities.

2. "The soil best calculated for the production of hops I consider to be a sandy loam, rather low and moist. I am led to this conclusion partly from my own observation, and further (considering nature an infallible instructer) from finding the lands which produce them naturally (intervals and the banks of large rivers) to be of this kind. Yet, I must observe, I have seen very fine crops raised on very different soils.

3. "I should recommend the following mode of preparing the land and managing the crop. In the fall (October) plough the land deep, nine or ten inches. In the spring following, pass a heavy, sharp iron-toothed harrow over the land in the same direction in which it was ploughed; after which, spread your manure evenly over the same, sixteen cords per acre, and more if the land be much reduced; then cross plough the land nearly the same depth, and furrow it as for planting corn, the furrows to be at least four feet apart.

4. "It is customary to plant corn or potatoes with the hops—(I should prefer potatoes.) Plant every other hill in every other row with hops, thus placing the hop hills at least eight feet apart. Put four cuttings from the running roots, about eight inches in length, into each hill, and cover them the common depth of potatoes. Many yards have been much injured by being planted too closely. It is

of great importance to have the hills so far distant from each other as to admit a free current of air to pass through the yard.

5. "All the attention requisite the first season after the hops are planted, is to keep them clean from weeds, which is easily done when hoing the crop planted among them. In the fall, (October,) to prevent their being injured by the hard frosts of winter, lay out of your cart one shovelful of compost nature on the top of each hill; manure from the hog sty I should prefer.

6. "In each following spring, before the hops are opened, as it is termed, spread evenly over the yard about eight cords of manure per acre, (coarse, strawy manure I should prefer, as it will have a tendency to keep the land loose,) and plough the field both ways at the first hoing. They require but three hoings in a season, unless necessary to subdue the weeds; the last of which should be performed when the hops are in full blossom, (about the beginning of August.)

7. "After the first crop, it is necessary to open the hops, every spring, by the middle of May; which is performed by making four furrows between the rows, turning the furrows from the hills, and running the plough as near to the same as possible without injuring the main roots. Then the earth is removed from the roots with a hoe, all the running roots cut in with a sharp knife within two inches of the main roots; the tops of the main roots must also be cut in, and then the hills covered with earth about two inches deep.

8. "The next thing necessary to be done is to set the poles. This should be done as soon as the

hop vines begin to make their appearance. By so doing, much time and labour will be saved in tying up the vines to the poles, as many of the vines will naturally take to the poles. There should not be to exceed two vines to one pole, nor to exceed two poles to one hill, nor any pole to exceed sixteen feet in height. Many yards have been very much injured by letting a greater number of vines grow on one pole, and almost destroyed by overpoling.

9. "Very much depends on paying due attention, in the spring, to select the most thrifty vines, and training them to the poles, which is done by fastening them to the poles with a piece of yarn, slightly twisted together with the thumb and finger. It will be necessary to inspect your hopyard frequently until the hops begin to blossom, and 'tie up the vines,' as it is termed, as they are subject to be blown off the poles by every high wind.

10. "As soon as the hops are ripe, which is about the beginning of September, they must be immediately gathered or the crop is lost. The quality of the hops depends considerably on their being picked clean from leaves and stems. The labour of picking or gathering the hops may be well performed by women and children, having one man to a bin to handle the poles and to inspect the pickers.

11. "The bin is a wooden box, about nine feet long, three feet wide, and two and a half feet high, made of thin pine boards, (that it may be easily moved over the yard,) across which the poles are laid, and into which the hops are picked by hand. Care should be taken, when gathering the hops, to

cut the vines two feet from the ground, that the roots may not be injured by bleeding.

12. "The most important part in the management of hops is the curing or drying of them. Here I would note that hops always grow first sort, and that all second sort and refuse hops are made so by unfortunate or unskilful management. Much depends on having a well-constructed kiln. For the convenience of putting the hops on the kiln, the side of the hill is generally chosen for its situation. Care should be taken that it be a dry situation.

13. The kiln should be dug out the same bigness at the bottom as at the top; the side walls laid up perpendicularly, and filled in solid with stone, to give it a tunnel form. Twelve feet square at the top, two feet square at the bottom, and at least eight feet deep, is deemed a convenient size. On the top of the walls sills are laid, having joists let into them in like manner as for laying a floor; on which laths, about one and a half inches wide, are nailed, leaving open spaces between them three fourths of an inch, over which a thin linen cloth is spread and nailed at the edges to the sills.

14. "A board about twelve inches wide is set up on each side of the kiln, on the inner edge of the sill, to form a bin to receive the hops. The larger the stones made use of in the construction of the kiln, the better; as it will give a more steady and dense heat. The inside of the kiln should be well plastered with mortar, to make it completely air tight. Charcoal (that made from yellow birch or maple I should prefer) is the only

fuel proper to be used in drying hops. The kiln should be well heated before any hops are put on, and carefully attended to keep a steady and regular heat.

15. "Fifty pounds of hops, when dried, is the largest quantity that should be dried at one time, on a kiln of this size; unless absolutely necessary to put on that quantity, a less would dry better. The green hops should be spread as evenly and as lightly as possible over the kiln. The fire at first should be moderate, but it may be increased as the hops dry and the steam is evaporated.

16. "Hops should not remain long in the bin or bag after they are picked, as they will very soon heat and become insipid. The hops should *not* be stirred on the kiln until they are completely and fully dried. Then they should be removed from the kiln into a dry room and laid in a heap, and there remain, unmoved and unstirred, until bagged, which is done with a screw, having a box made of plank, the size the bag is wished, into which the cloth is laid, and the hops screwed into the box, which is so constructed that the sides may be removed, and the bag sewed together while in the press.

17. "The hops, after lying a few days, will gather a partial moisture, called a sweat. The sweat will probably begin to subside in about eight days, at which time, and before the sweat is off, they ought to be bagged in clear dry weather. As the exact time when the hops will begin to sweat, and when the sweat will begin to subside or dry off, (the proper time to bag them,) will vary with the state of the atmosphere, it will be necessary to

examine the hops from day to day, which is easily done by taking some of them from the centre of the heap with your hand.

18. "If on examination you find the hops to be very damp, and their colour altering, which will be the case if they were not completely dried on the kiln and not otherwise, you must overhaul them and dry them in the air. The most convenient size for a bag of hops to handle and transport, is about five feet in length, and to contain *about two hundred and fifty pounds.*

19. "The best bagging is coarse strong tow cloth of our domestic manufacturing; next to that Russia hemp bagging. The East India sugar and gunny bags, so called, ought never to be used. The sugar bags are of an unreasonable weight, and both they and the gunny bags are of no value to the brewer; whereas the other bags are worth prime cost.

20. "It is now common for those who have entered considerably into the cultivation of hops to build houses over their kilns, which in wet weather are very convenient; otherwise, a kiln in the open air would, in my opinion, be preferable. It is necessary to have these buildings well ventilated with doors and windows; and to have these kept open night and day, except in wet weather, and then shut those only which are necessary to keep out the rain.

21. "If a ventilator was put in the roof of the building, directly over the centre of the kiln, about six feet square, built like those in breweries and distilleries, I am of the opinion it would be found very advantageous. I have seen many lots of

hops much injured both in colour and flavour by being dried in close buildings.

22. "Where the houses over the kilns are built large, for the purpose of storing the hops as they are dried, which is a great saving of labour, a close partition should be made between the kilns and the room in which the hops are stored, to prevent the damp steam from the kilns coming to them, as it will colour them, and injure their flavour and quality very much.

23. "I expect that many of our farmers will object to the mode of manuring hops which I have recommended, their common practice being to put the manure in the hills when they plant the hops, and afterward to apply the manure on the hills at the first and second hoings. I find the hop roots very liable to be injured by the worms, and to decay.

24. "My opinion is, that the manure in the hill has a tendency to produce the worms, and its fermentation at their roots to cause their decay; and that the crop is not more, if as abundant, as when manured in the manner I have recommended: and, further, that a hopyard manured in this manner will continue in a healthy state for many years.

25. "I also expect that the quantity of manure I have recommended will be objected to by many, it being a commonly received opinion that hops should have little or no manure. I find it a general complaint among the farmers where hops have been cultivated many years, that the quantity raised per acre does not exceed the one half raised by their ancestors on the same

land; inferring that the 'hops are running out,' as it is termed, and cannot now be cultivated to advantage.

26. "Hops, I believe, in common with all sorts of grain and vegetables, flourish best and produce the finest crops when cultivated on new lands, which require little or no manure; and such were the lands which their ancestors cultivated. The same complaint, I presume, would be made against all sorts of grain and vegetables, if raised with little or no manure, on lands that have long been cultivated. From my own observations, I am confident that no crop can be more improved and increased by high cultivation than hops."—*William Blanchard, Jr.*

CHAPTER XXIV.

RUTABAGA.

1. The following is an account of the method of cultivating rutabaga, adopted by the Rev. Henry Colman, in obtaining a crop for which he received a premium of twenty dollars from the Massachusetts Agricultural Society, in the year 1830. From the New England Farmer, vol. ix., p. 284.

2. "Gentlemen—Accompanying this you have the certificates of a crop of rutabaga raised this year on my farm in Lynn. From these it will appear that on an acre, measured by a sworn surveyor, on one side of the field, were gathered

seven hundred and forty-one basketfuls; and that forty baskets of the above named weighed at the town scales two thousand seven hundred and fifty pounds net weight.

3. "This, allowing fifty-six pounds to a bushel, the standard weight assumed by the society, would give a crop of nine hundred and three bushels to the acre. The turnips were planted on the twenty-ninth of June and second of July; about one pound and a half of seed was used for the acre; and they were gathered and stored in cellars and in the barn, in the last part of November.

4. "The ground on which they grew is a good soil, neither wet nor dry, and bore the last year an abundant crop of onions, and corn the year preceding the last. It was well manured at both times, and in fine tilth. It was manured with at least six cords to the acre of barn manure the last spring, and sowed again to onions; but the seed entirely failing, it was ploughed, harrowed, furrows struck out, and about eight cords of barn manure spread in the furrows; ploughed again so as by a back furrow to form a ridge over the manure, and the seed sown with a small drill harrow on the ridges, making the rows about twenty inches asunder.

5. "As soon as the plants were of sufficient size, a drill harrow, with small shares fixed to it, to cut off all the weeds, was passed through the rows; and the plants were thinned with a small weeding hoe to the distance of about eight inches apart, and the vacant places filled up by transplanting from the supernumerary plants. They were once more harrowed and cleaned, which was a very

small labour; and owing to the very unpropitious weather, were not harvested until very late.

6. "Some of them were very large; one weighed fifteen pounds, and many were nearly as large. The exact expense of cultivating the acre cannot be estimated, as it was intermixed with other farmwork; but the whole, from the sowing to the gathering, was not two thirds of the labour usually bestowed on planting, cultivating, and gathering an acre of potatoes.

7. "My Swedish turnips the last year, of which I raised considerable quantities, were fed off to my oxen, dry cows, young stock, and fatting sheep. To the cattle they were of very great advantage; and for feeding sheep, they proved the last year, by an accurate account, worth from ten to twelve and a half cents per bushel. The man who has the care of my stock considers them as among the most profitable feed which can be given either to fatting or to store cattle. Three years' experiment has increased their value very much for these purposes in my own estimation."

8. A correspondent in the New England Farmer, vol. xi., p. 277, writes thus: "A wish to have others profit by my experience has induced me to send you, Mr. Editor, half a sheet of remarks on the culture of the rutabaga as a food for domestic animals. I have cultivated from half an acre to three acres of this root every year for thirteen years in succession, and feel competent to give rules for its culture, and confidence in recommending it as a valuable and profitable crop.

9. "The soil must be rich and dry; and the more it inclines to a sand loam the better. Clay is the worst, and wet soils will not answer at all. *Preparations.* My general practice has been, to manure well a piece of pasture, or clover ley, from which the hay has first been cut, plough it handsomely over, and harrow it well.

10. "*Sowing, &c.* I sow in rows, at two and a half or three feet, with a drill harrow. The sooner the preceding operations succeed each other the better. I have sown broadcast, but the expense of thinning and culture is increased. A man will drill in three or four acres a day. We allow a pound of seed to the acre, though half this, properly distributed, is enough. Sow from the twenty-sixth of June to the tenth of July.

11. "*Culture.* I use a cultivator, that may be graduated to the space between the rows, drawn by a horse, as soon as the plants can be well distinguished. This is repeated in a few days, back and forward, and the implement carried so close to the drills, as to leave only strips of from four to ten inches, which are then thoroughly cleaned with a skim hoe, and the plants thinned to eight and ten inches' distance. The cultivator soon follows for a third time, and if necessary, the skim hoe, when the crop is generally left till harvest. The great aim is to extirpate the weeds, and to do this while they are small.

12. "Harvesting is postponed as long as the season will permit. The roots are then pulled up and laid on the ground, the tops of the two rows towards each other. The pullers are followed by

a man or boy with a bill hook, who with a light blow cuts the tops as fast as three or four can pull. Three men will in this way harvest, of a good crop, three hundred bushels in a day.

13. "The tops are gathered into heaps and taken to the yard in carts daily, for the stock, until they are consumed. An acre will give from five to ten cartloads of tops. The roots are piled in the field if dry; the pits, two or two and a half feet broad, covered with straw and earth, and as cold weather approaches, with manure, to prevent frost. N. B. With a crowbar make one or more holes on the crown of the pit, which must be left open, to let off the rarified air and prevent the roots from heating.

14. "*Use.* The tops serve for autumn. As soon as the mild weather of spring will justify, I break through the frost, and take the contents of a pit to my barn, and cover the roots with straw or hay. From thence they are fed to my stock, being first chopped up with a *snik*, (Dutch meat-chopper,) or spade. They are excellent for sheep, especially for ewes that have young; and hogs and horses eat them freely. Steamed, they are used in the north of England for horses as a substitute for grain.

15. "I have fattened sheep and bullocks upon them with profit. They constitute, particularly from February to June, an excellent culinary vegetable for the table. A bullock will thrive fast upon two bushels a day, and will consume hardly any hay, and requires no drink.

16. "*Product and Cost.* My average crop has been six hundred bushels per acre, though others

have raised much heavier products. The cost in manure and labour, when they are secured for winter, has been from two to three cents per bushel."

CHAPTER XXV.

PASTURE.

1. "To manage pasture land advantageously, it should be well fenced in small lots, of four, eight, or twelve acres, according to the largeness of one's farm and stock; and these lots should be bordered at least with rows of trees. It is best that trees of some kind or other should be growing scattered in every point of a pasture, so that the cattle may never have to go far in a hot hour to obtain a comfortable shade. The grass will spring earlier in lots that are thus sheltered, and they will bear drought the better. But too great a proportion of shade should be avoided, as it will give a sourness to the grass.

2. "Small lots thus sheltered are not left bare of snow so early in the spring as larger ones lying bare, as fences and trees cause more of it to remain upon the ground. The cold winds in March and April hurt the grass much when the ground is bare. And the winds in winter will not suffer snow to lie deep on land that is too open to the rake of winds and storms.

3. "It is hurtful to pastures to turn in cattle too

early in the spring ; and most hurtful to those pastures in which the grass springs earliest, as in very low and wet pastures. Potching such land in the spring destroys the sward, so that it will produce the less quantity of grass. Neither should cattle be let into any pasture until the grass is so much grown as to afford them a good bite, so that they may fill themselves without rambling over the whole lot.

4. "The twentieth of May is early enough to turn cattle into almost any of our pastures. Out of some they should be kept later. The driest pastures should be used first, though in them the grass is shortest, that the potching of the ground in the wettest may be prevented.

5. "The bushes and shrubs that rise in pastures should be cut in the most likely times to destroy them. Thistles and other bad weeds should be cut down before their seeds have ripened ; and ant hills should be destroyed. Much may be done towards subduing a bushy pasture by keeping cattle hungry in it. A continual browsing keeps down the young shoots, and totally kills many of the bushes. Steers and heifers may mend such a pasture, and continue growing.

6. "But as to cleared pastures, it is not right to turn in all sorts of cattle promiscuously. Milch kine, working oxen, and fatting beasts, should have the first feeding of an enclosure ; afterward, sheep and horses. When the first lot is thus fed off, it should be shut up, and the dung that has been dropped should be beaten to pieces, and well scattered. Afterward, the second pasture should be treated in the same manner, and the rest in

course, feeding the wettest pasture after the driest, that the soil may be less potched.

7. "Something considerable is saved by letting all sorts of grazing animals take their turn in a pasture. By means of this, nearly all the herbage produced will be eaten; much of which would otherwise be lost. Horses will eat the leavings of horned cattle; and sheep will eat some things that both the one and the other leave.

8. "But if in a course of pasturing, by means of a fruitful year, or a scanty stock of cattle, some grass of a good kind should run up to seed and not be eaten, it need not be regretted; for a new supply of seed will fill the ground with new roots, which are better than old ones. And I know of no grass that never needs renewing from the seed.

9. "A farmer need not to be told, that if he turn swine into a pasture, they should have rings in their noses, unless brakes and other weeds need to be rooted out. Swine may do service in this way. They should never have the first of the feed; for they will foul the grass, and make it distasteful to horses and cattle.

10. "Let the stock of a farmer be greater or less, he should have at least four enclosures of pasture land. One enclosure may be fed two weeks, and then shut up to grow; then another. Each one will recruit well in six weeks; and each will have this space of time to recruit. But in the latter part of October, the cattle may range through all the lots, unless some one has become too wet and soft. In this case, it ought to be shut up, and kept so till feeding time the next year.

11. "But that farmers may not be troubled with

low miry pastures, they should drain them, if it be practicable, or can be done consistently with their other business. If they should produce a smaller quantity of grass afterward, it will be sweeter, and of more value. It is well known, that cattle fatted in a dry pasture have better-tasted flesh than those fatted in a wet one. In the old countries it will fetch a higher price. This is particularly the case as to mutton.

12. "Feeding pastures in rotation is of greater advantage than some are apt to imagine. One acre, managed according to the above directions, will turn to better account, as some say who have practised it, than three acres in the common way.

13. "By the common way I would be understood to mean, having weak and tottering fences, that will drop of themselves in a few months, and never can resist the violence of disorderly cattle; suffering weeds and bushes to overrun the land; keeping all the pasture land in one enclosure; turning in all sorts of stock together; suffering the fence to drop down in autumn, so as to lay the pasture common to all the cattle and swine that please to enter; and not putting up the fence again till the first of May, or later. Such management is too common in all parts of this country with which I am most acquainted. I would hope it is not universal.

14. "Land which is constantly used as pasture will be enriched. Therefore it is advisable to mow a pasture lot once in three or four years, if the surface be so level as to admit of it. In the mean time, to make amends for the loss of pasture, a mowing lot may be pastured. It will thus be im-

proved; and if the grass do not grow so rank afterward in the pasture lot, it will be more clear of weeds, and bear better grass. Alternate pasturing and mowing has the advantage of saving a good deal of expense and trouble in manuring the mowing grounds.

15. "Though pastures need manuring less than other lands, yet, when bushes, bad weeds, &c. are burned upon them, the ashes should be spread thinly over the surface. The grass will thus be improved; and grass seeds should be sown upon the burnt spots, that no part may be vacant of grass.

16. "Sheep, calves, and horses, unless they are worked, it is said, require no water in their pastures. The want of water induces them to feed in the night, when the dew is on and the grass the more nutritious. Cows, however, want pure water. In pastures which are on hillsides, water may generally be obtained by digging horizontally into the side of the hill till it is found, and then carrying it out with a pipe."—*Deane.*

17. We learn from English writers on agriculture, that three modes have been adopted in Great Britain for consuming clover and other herbage plants by pasturing. These are tethering, or fastening the feeding animal to a stake, hurdling, and free pasturage. In the *Agricultural Report of Aberdeenshire*, it is stated that there are some cases in which the plan of tethering can be practised with more profit than even soiling.

18. "In the neighbourhood of Peterhead, for instance, they tether milch cows on their grass fields, in a regular and systematic method, moving each

tether forward in a straight line, not above one foot at a time, so as to prevent the cows from treading on the grass that is to be eaten ; care being always taken to move the tether forward, like a person cutting clover with a scythe, from one end of the field to the other.

19. " In this way, a greater number of cows can be kept on the same quantity of grass than by any other plan, except where it grows high enough to be cut and given them green in houses. In one instance, the system was carried to great perfection by a gentleman who kept a few sheep upon longer tethers, following the cows.

20. " Sometimes also he tethered horses afterward upon the same field, which prevented any possible waste, for the tufts of grass produced by the dung of one species of animal will be eaten by those of another kind without reluctance. This mode was peculiarly calculated for the cowfeeders in Peterhead : as from the smallness of their holdings they could not keep servants to cut or horses to carry home the grass to their houses, to be consumed in a green state.

21. " In hurdling off clover or herbage crops, a portion of the field is enclosed by hurdles," [moveable wooden fences,] " in which sheep are confined, and as the crop is consumed the pen is changed to a fresh place, until the whole is fed off. This practice is very extensively adopted at Holkham," [England,] " and is peculiarly calculated for light and dry soils. Its advantages are, that the grass is more economically consumed ; that the stock thrives better, having daily a fresh bite ; and that

the dung which falls, being more concentrated, is more likely to be of use."—*Loudon.*

22. Water should be provided for every field under pasture; and also shelter and shade, either by a few trees, or by a portable shed, which may be moved with the stock from one enclosure to another. Where there are no trees, rubbing posts are also a desirable addition. In Germany they have portable sheds which are employed both in summer and winter, and generally with a piece of rock salt fixed to a post for the cattle to lick at will.

23. Some graziers mix a few sheep and one or two colts in each pasture, which both turn to account, and do little injury to the grazing cattle. In some cases, we are told that sheep are beneficial to pastures, by eating down and destroying white weed, and some other useless and pernicious plants.

24. So various is the appetite of animals, that there is scarcely any plant which is not chosen by some and left untouched by others. The following is said to be a fact, known and practised on by graziers in Holland. When eight cows have been in a pasture, and can no longer obtain nourishment, two horses will do very well there for some days, and when nothing is left for the horses, four sheep will live upon it; this not only proceeds from their differing in the choice of plants, but from the formation of their mouths, which are not equally adapted to lay hold of the grass.

25. Stocking a pasture with as many sheep as it will support is recommended for forming a ten-

der herbage, and causing the grass to mat or grow very thick at the bottom. An English writer says, "In turning out horses to grass in the spring, it is usual to choose the forenoon of a fine day to do it in; the natural consequence is, the horse fills his belly during the sunshine, and lies down to rest during the cold of the night, thereby probably exposing himself to disorders. In some parts of Yorkshire a better practice prevails: the horse is turned out at bedtime; the consequence is, he eats all night, and sleeps in the sunshine of the next day."

CHAPTER XXVI.

THE CULTURE OF SILK.

1. THE principal articles made use of for clothing among civilized people are wool, flax, cotton, and silk, all of which consisting of fine fibres, those fibres are twisted into threads, and woven into various kinds of cloth. Each of these possesses, perhaps, some peculiar advantage in quality which the others do not; but that which universally holds a most decided preference over all the others is *silk*.

2. It is superior in strength, and infinitely so in softness and in beauty. It is produced by a large insect of the caterpillar kind called in English the silkworm, but in natural history is commonly called the *bombix mori* or *mulberry caterpillar*. This

worm spins out the silk from the substance of its own body, winding itself up in a ball, which, when finished, is about the size and shape of a robin's egg.

3. From this ball, which is called a *cocoon*, the silk is wound off for use, in a continuous thread, from the outside to the centre, which contains the *chrysalis*, or the remains of the worm when it has done spinning. If the silk is not wound off in a few days after the cocoon is completed, the chrysalis changes its form, and comes out in that of a *moth* or small butterfly, of a whitish-gray colour, and of a very clumsy form, being incapable of flying, though it has wings.

4. In a few hours after leaving the cocoon the female moth lays her eggs, which are about the size of a mustard seed, and from two to four hundred in number. These eggs are preserved in a cool place until a fresh crop or litter of worms is wanted, when they are placed in a warm atmosphere, where they hatch spontaneously in a short time.

5. The worms are at first very small, but being fed on the leaves of the mulberry tree, they grow to nearly or quite the size and length of a finger, and commence spinning cocoons as before. The cocoons from which the silk is to be wound or reeled are exposed to heat by steaming, baking, or otherwise to kill the chrysalis.

CHAPTER XXVII.

HISTORY OF SILK.

1. The discovery of the use of silk, and the modes of procuring and manufacturing it, was unquestionably made by the Chinese at a period of very remote antiquity; we know nothing, therefore, of its early history, except what we learn from them.

2. The account they give us is, that it was discovered in its native forests of mulberry; and that about seven hundred years before the days of Abraham, an emperor called Haung-to, whose name they hold in great veneration, persuaded his wife, Si-ling-chi, to have the silkworms gathered and domesticated, and to teach his subjects the management of them, and use of the silk. If this account be true, the first silk grower was an emperor.

3. The silk business, however, appears to have been for a long time, probably for many ages, confined to a part of the Chinese dominions, called Serica. But in process of time, garments composed of it were carried by traders, travelling in caravans, through trackless sands and deserts to Syria and Egypt, a journey which it took about eight or nine months to perform.

4. These garments were sold to merchants, who again sold them at enormous prices, and they were, no doubt, for a long period the principal source of wealth to the last-mentioned nations.

5. This tedious overland carrying trade was, for a long time, chiefly monopolized by the Persians, who, about three hundred and fifty years before the Christian era, extended it to Greece, where the silk found a prodigious demand, owing to the immense wealth of the Grecians; and the Phœnicians also engaging in the trade, it found its way throughout the south of Europe. But even those who brought it to Europe knew not what it was, where it came from, nor how it was produced.

6. By the Romans in the third and fourth centuries it was considered an article of too much extravagance to be indulged in, except by those of immense wealth and pride. But about the fifth, and beginning of the sixth century, it began to be a subject of inquiry among the Romans, from what part of the world this precious article came, and what was the secret of its production.

7. About this time, two monks, who had been missionaries to China, returned, and brought with them the seed of the mulberry, and gave information how the silkworms were reared and fed upon the leaves, and how those worms spun the silk. But to carry the silkworms or their eggs out of China was forbidden on pain of death.

8. Still, however, in consequence of the liberal rewards offered by the Emperor Justinian, these persevering individuals returned, and after a long pilgrimage, having obtained the eggs at the risk of their lives, brought them to the emperor concealed in a hollow cane.

9. The culture of silk was now engaged in by families of the highest standing; but was chiefly

carried on under the immediate protection of the emperor, for his own benefit; but at his death, the monopoly could be maintained no longer, and the business was entered into by individuals with great avidity; and during four hundred years the silk was distributed by the Venetian merchants throughout the west of Europe.

10. But in the year 1146, Roger the Norman, king of Sicily, invaded Greece, and capturing a great number of silk growers and weavers, carried them to Palermo, his capitol. By the Saracens also it was carried into Spain, and it soon after found its way into Italy, where, in 1306, it was so far advanced as to yield a revenue to the state.

11. It now also found its way into France, and was encouraged by Louis XI. and Charles VIII., and still more by Henry IV., who established it as one of the principal sources of wealth to his nation, which standing it has maintained ever since.

12. It began to be introduced into England a little before, and during the reign of Elizabeth; and James I. endeavoured much to establish the silk culture in that kingdom. He addressed letters, written with his own hand, to the lord lieutenants of every county in the kingdom, accompanied with mulberry seeds and plants, together with a book of instructions. But though near the close of his reign he effected something towards establishing the manufacture of silk, nothing profitable was done in its production, and probably never can be in that kingdom, owing to the humidity of the atmosphere.

13. In the reign of George II. much was effected in improving the silk manufacture by Sir Thomas Lamb, and his brothers John and Henry, and it has increased progressively to the present time. The throwsting mill, erected by the Lambs in Derby, is still standing, and is regarded with great interest, though its usefulness is much superseded by subsequent improvements.

14. It was probably owing to the difficulty of producing silk in England that attempts were made to introduce it into the then British colonies, as early as the twentieth year of the reign of James I., who gave special instructions to the Earl of Southampton, that as he had "understood that the soil of Virginia naturally yieldeth stores of excellent mulberries, he would urge the cultivation of silk, in preference to tobacco, which bringeth with it many disorders and inconveniences."

15. In 1623, the colonial assembly directed mulberry trees to be planted; and soon after laid a penalty of three pounds of tobacco upon every planter who should fail to plant at least ten mulberry trees for every hundred acres of land in his possession. A premium of ten thousand pounds of tobacco was offered to any person who should export two thousand pounds worth of raw silk.

16. These encouragements had, in a great measure, the desired effect, the agriculturists engaged spiritedly in the business, and great numbers of mulberry trees were planted. Among others, a Mr. Walker had seventy thousand trees growing in 1664. "As early as 1732, at the settlement of Georgia, the lands were granted upon the express condition that one hundred white mulberry trees

should be set on every ten acres of land when cleared.

17. In 1755, Mrs. Pinckney, a very distinguished lady of South Carolina, took with her to England a sufficient quantity of very superior silk to make three dresses. Considerable sewing silk was made in Georgia during the war of the revolution. In 1770, a filature for reeling silk was established at Philadelphia.

18. But the silk growing and manufacturing enterprise appears to have been wholly lost sight of during the general confusion and distress which prevailed during the revolution, except in Connecticut, where it had been introduced as early as 1760, by the patriotic exertions of a Mr. Aspinwal, and where it has been continued upon a small scale ever since; but this has been chiefly confined to sewing silk.

19. But a general awakening to a sense of the great importance of the silk growing and manufacturing interest has lately taken place, and now appears to extend through every part of the United States; and there is every reason to anticipate a most successful result.

CHAPTER XXVIII.

SILK CONTINUED.—MODE OF PROCEEDING IN REARING THE WORMS AND PRODUCING SILK.

1. The first step in the silk business is to procure and have in readiness an ample supply of food for the number of worms intended to be kept, which food consists chiefly of the leaves of the mulberry tree; though there are many other leaves on which they may occasionally be fed, particularly the lettuce; but it is doubtful whether anything except the mulberry leaves can be permanently depended on, either for sustaining the worms or producing silk.

2. There are several species and numerous varieties of the mulberry, some of which are indigenous in this country, and others of foreign origin; but though the silkworm will feed on nearly all of them, yet some are much preferable to others.

3. It was formerly supposed that none but the white Italian mulberry would answer the purpose; but lately, beautiful specimens of silk have been exhibited from worms fed on leaves of several kinds of native mulberry, particularly the red and the purple. White mulberries are also found in some of the most remote forests in the United States, probably equal in value to those brought from Italy.

4. But several varieties have recently been in-

troduced from different parts of the world, which appear to be greatly superior to those formerly in use, among which are the Dandolo, the Brusa, and the Chinese or morus multicaulis, which last takes its name from the multitude of slender stalks or sprouts which shoot up from it.

5. From present appearances, this may be safely pronounced superior to any other for feeding silk-worms. Its leaves are exceedingly large, and from its low and shrublike form, they require much less time and labour in gathering—they are much sooner brought to maturity—are more palatable and more nutritious to the worms, and produce more and better silk.

6. When a sufficient number of mulberry plants have been propagated, and have grown large enough to be divested of their leaves, the next step will be to procure a small stock of eggs. This with the Chinese mulberry may be effected in a very short time, for the young trees may be multiplied by layers and cuttings from ten to a hundred fold annually; and considerable quantities of leaves may be taken from them the second year from the seed-bed.

7. When the trees have begun to put forth their leaves in the spring, the eggs of the silkmoth are placed in a warm situation (but not in the direct rays of the sun) to produce hatching, which will take place in about five or six days.

8. When the worms are hatched, they attach themselves to the leaves of small twigs of mulberry, by which they are carried to the place where they are to be fed. They are then about the twelfth

part of an inch in length, and those that are healthy are generally of a black colour.

9. In the first stage of feeding the worm, they may be laid on tables, on shelves, or even on rough boards temporarily placed for the purpose, and covered with paper, and fed with tender leaves chopped fine. In about four days, they begin to appear torpid, and cease eating, in which state they remain twenty-four or twenty-six hours, during which time they shed their skin, which is called moulting.

10. This operation they generally perform four times, and the intervening times before, between, and after the moultings are called ages. The first four ages are from four to eight days each, and the fifth and last age occupies about ten days, at which time the worms attain their full size.

11. As the silkworms increase in size they increase also in appetite, and especially during the last ages they devour large quantities of leaves. About the thirty-second day they generally cease feeding, and prepare to spin their cocoons. Little twigs, especially of oak, with the leaves on and dried, are then placed for them to climb on, when they commence spinning, and winding themselves in, and in about from four to eight days they complete their work.

12. The cocoons intended to be reserved for eggs are then selected, and in about twelve days the moth will come out. They are then placed on papers in pairs, male and female, in a dark room; and in from twenty-four to thirty-six hours from the time of leaving the cocoon, the female moth will have laid her complement of eggs, which is

generally from three to four hundred. Both the male and female die shortly after the female has done laying her eggs, and never eat after leaving the cocoons.

13. Those cocoons which are designed for producing silk are prepared by killing, or, as it is commonly called, stifling the chrysalis, which is done by baking or steaming, or sometimes by the heat of the sun; and being thus prepared they are ready for reeling.

14. When the silk is to be reeled, several cocoons are placed together in a vessel of hot water, in order to soften the gummy or glutinous matter which holds the fibres of the cocoon together. By stirring them round in the hot water with a kind of wisp, the ends of the fibres are collected, and the silk is reeled off with a brisk motion, each cocoon yielding a continuous fibre several hundred yards in length.

15. As these fibres, taken singly, would be too fine for use, several of them are united together in reeling, and the glutinous substance connected with the silk connects and binds them in a single thread, of any size required. It may be reeled on any common reel, but when the business is extended, long experience has dictated a form of reels much better adapted to the purpose.

16. The silk thus reeled is called *raw silk*, and intended for market in that state, is sold by the pound, in skeins or hanks. The ingenious Mr. Gay of Providence has invented a plan of winding the silk from the cocoons on spools or bobbins which bids fair to be a valuable improvement.

17. The loose fibres which surround the co-

coons previous to reeling are carefully separated, and are called floss, or waste silk. Those cocoons, also, in which the chrysalis has been preserved, and others, from not being perfectly formed, and of course not susceptible of being reeled, are denominated waste silk, and when carded and spun, answer a variety of purposes.

18. The establishments where silk is reeled are called filatures, some of which are very extensive, and the buildings appropriated to rearing and feeding silkworms are called cocooneries.

19. The raw silk is transferred to the manufacturer, who transforms it into the elegant articles of dress and ornament we see offered for sale; in many of which great ingenuity and refined taste are displayed. But the people who produce them in foreign countries, from whence we import many millions of dollars worth every year, have no more ingenuity, and probably, in most cases, less refinement of taste, and less enterprise, than the people of our own country; and no article of silk can be imported that cannot, in a short time, be produced in this country of equal value and beauty.

20. The production of silk is certainly one of the most lucrative, as well as pleasing and interesting employments which human industry can be engaged in. In the cultivation of the Chinese mulberry itself—the facility with which it is propagated by cuttings or layers—its peculiar tenacity of life—its beauty as a shrub, with its numerous stalks, bending with their burden of broad and shining leaves, cannot but afford pleasure to an agriculturist of any refinement of taste.

21. The gathering the leaves and feeding the

worms give light and wholesome exercise, enlivened by the anticipation of a rich reward; while the spectacle of millions of insects feeding with avidity and growing in a few days, from a scarcely visible speck to several inches in length; then almost simultaneously ceasing to eat and commencing to spin and wind themselves in a thick coat of silk, affording more than ample compensation for the food they have received; after a few days reappearing, changed to a butterfly, for no apparent purpose but to deposite the eggs for a succeeding generation, must be, to a reflecting mind, a rich subject for contemplation.

22. It must afford no less agreeable anticipations to the patriot, to reflect that in a very few years the growing and manufacture of silk in the United States will not only afford a living, and perhaps wealth to thousands, who are now, and would otherwise remain poor and destitute, but will save to the country the immense sums which are now annually sent out of it to purchase articles which we can as well produce ourselves, and probably cheaper than those from whom we buy them.

23. The growth of silk is peculiarly adapted to the minds, capacities, and tastes of youth of both sexes; we fondly hope, therefore, that those of that class into whose hands this little book may fall, will feel sufficiently awakened by the importance of the subject to endeavour to become more fully acquainted with it, which they can do by procuring such publications as treat of it more extensively, and perfecting the knowledge thus acquired by practice.

24. The best source to which we can refer our readers for a thorough knowledge of the silk business is "*The Silkworm*," a monthly periodical, published in Albany, by Mr. S. Blydenburgh, and we believe the only one in the United States, and perhaps in the world, devoted solely to the subject.

CHAPTER XXIX.

SUGAR MADE FROM BEETS.

WHAT is here said on beet sugar is taken from Pedder's Report to the "Beet Sugar Society of Pennsylvania." The latest information from the highest authority.

1. "What is the quality of land best suited to the growth of the beet? A healthy subsoil is indispensable; after this, it is cultivated on almost any, of course, with various degrees of success. In the neighbourhood of Boulogne, the manufacture of sugar from the beet has been discontinued, *expressly* on account of the unsuitableness of the soil, which is chalk, with a very shallow depth of mould.

2. "Monsieur C—— considers the soil of New-Jersey (*a sandy soil, not apt to burn in the summer*) as very likely to be excellent for the purpose; the facility with which the crop might be taken up, and the advantages of obtaining the roots free from filth or clay, are valuable considerations; the

latter will conduce much to their preservation during the winter.

3. "What is the mode of cultivation? Plough the land in winter and lay it dry; obtain a pulverized surface before sowing, and drill the seed eight pounds per acre; hoe the land in the intervals of the rows (which might be twenty inches apart if the land is not very rich, or twenty-four inches) as soon as the plants have made tolerable progress; at the second hoing, thin the plants in the rows to the distance of about fifteen inches, and the third hoing may be performed with a horse hoe.

4. "Which are the best kinds of seed? The white or Silesian, and the rose coloured are the only kinds now sown in a large way; the yellow is still sown by a few, but to no great extent. Other kinds are said not only to yield no sugar, but to be destructive to the process of crystallization, if mixed or worked with them. The greatest care is taken to select the best roots for the production of seed, both as to their kinds and perfect formation; the largest roots are not the best for this purpose.

5. "Which is the best time for sowing the seed? As early as the season will admit, as the greatest advantage is derived from an early crushing; sometimes as much as two per cent. of sugar, besides the ease with which it is made to crystallize, the quality being also superior: the latter part of April and all May is considered the proper season, but this might be extended to the first day of June.

6. "When is the proper time for taking up the

crop? For reasons just stated, the crop should be taken up as soon as the roots have completed their growth; the months of September and October are the proper seasons.

7. "What is the manner of protecting the crops during winter? Heat is as injurious to the roots as cold, as it induces fermentation, which is destructive of the saccharine. The best-preserved roots which I have seen were deposited in long trenches, formed by throwing out the earth to the sides, and forming with it sloping banks 2½ feet in height; these trenches were 10 feet wide and about 100 feet long, in a dry soil, where the roots were packed without straw either at the bottom or sides, the tops of the heaps conical, and covered with a slight coat of straw, which was thickened during the severity of winter.

8. "But the almost universal practice is to bury them in pits, dug in the fields where the roots are grown, 17 feet long, 2½ feet deep, and 2 feet broad; each pit contains 3000 pounds of roots, is dug and the roots covered for one franc, or twenty cents per pit. This is by no means a good method; the throwing out of the earth mixes a great quantity of the steril subsoil with the enriched upper stratum, and removing the roots during winter is the cause of much injury to the soil, by the cutting in of wheels in wet weather; it prevents also the proper cultivation of the land, by ploughing to lay dry.

9. "What is the method of manufacturing sugar in all its processes? The manufacture of sugar consists of seven distinct processes.

10. "*Cleaning the Roots.* In many large facto-

ries this is done by washing in long wooden cylinders, with open sides, which revolve by the power of steam in cisterns of water: the roots are thrown in at one end of this cylinder and are carried round and ejected at the other by a spiral or Archimedes' screw; and if the work could be effectually performed by this means, it would be a great saving of expense, but the fact is, it is at best a most inefficient mode.

11. "If the roots have grown in a stiff soil, quantities of earth will still be found adhering to them, maugre all your attempts to free them from it. This will do great injury to the teeth of the rasp while crushing, and will, I presume, be of no value in the cake as food for sheep or cattle. The large roots are often found to be hollow and partially decayed at the crown; this putrid matter being acetous, is peculiarly destructive to the yield of saccharine, and no washing will remove it.

12. "The end of the tap root and the lateral fibres are almost useless to the production of sugar —often very injurious; I therefore prefer to clean by scraping with a knife, when the earth and decayed parts are easily removed: the cuttings are greedily devoured by cattle and hogs, and that portion only of the root is used which is best calculated to yield a superior quality of sugar.

13. "*Crushing or Rasping the Roots.* In no manufactory, except where maceration is practised, is this process performed by any other means than by the rasp. This is a wooden barrel, set transversely with steel saws at half an inch apart. It is 13½ inches wide, and 23 inches diameter, and when propelled by steam makes about 900 revolu-

tions in a minute, crushing into impalpable pulp 90 pounds of roots in that space of time. Pressing by cylinders has often been tried, but found to be totally inapplicable to the purpose.

14. " *Pressing the Pulp.* The heat engendered by the process of rasping brings on instantaneous fermentation, which is destructive to the yield of sugar: no time is therefore lost in submitting the pulp to the action of the press, by which the juice is extracted in a surprisingly short space of time. In no instance did I see this operation performed by any but hydraulic pressure, the power of which is astonishingly great.

15. " The machine for this purpose is very expensive, but when obtained, the saving of labour and time is great. The pulp falls from the rasp into a square box below, from whence it is taken in a deep *wooden* or *copper* shovel and put into a bag which is held open for its reception ; it is then placed upon a frame of wicker work, standing upon a small handbarrow resting upon wheels, where it is spread evenly in the bag, and the mouth is then turned down to prevent the escape of the pulp while under the press ; it is then covered by another wicker frame and another bag, until the pile consists of thirty-five bags and wicker frames.

16. " The whole is then removed to the press, where a man takes and deposites them on the wooden platform, which rests on the bed of the press, and the pressure is then applied. So soon as the juice is extracted, the pressure is taken off, the bags are emptied of the dry cakes, and the press is ready for another load.

17. " These presses are always worked in

pairs, so that while one is pressing the other is being loaded. The juice flows from the press into a cistern beneath the floor, whence it is immediately pumped into the defficating pan, which is placed so high that the contents may flow from it by a pipe into the evaporator.

18. "*Deffication.* The defficator is a copper pan, into which the juice is pumped, so as to fill it within four inches of the top, when heat is applied either by means of steam or fire. As soon as the juice has attained the heat of 58° Reaumur (162½° Fahrenheit) lime is added in exact proportion to the acid contained in it, which is ascertained by chymical tests. This lime is prepared by slacking with *hot* water and mixing, so as to be of the consistence of cream, and when it is added the greatest care is taken to mix it most intimately with the juice by stirring it with a wooden spatula.

19. "After this it is suffered to rest, and the heat is raised to the boiling point, when it is suddenly checked by withdrawing the steam or fire; as soon as the juice has become perfectly clear, it is run off into the first evaporator, taking care that none of the scum or sediment at the bottom of the pan passes with it. The scum and sediment are then collected, put into bags and pressed, to obtain all the juice they contain; after which, the residuum is thrown to the dunghill, a valuable manure.

20. "*Evaporation.* The evaporator is a copper pan, into which the clear defficated liquor flows, until the pan is about a third part full; to this a small quantity of animal charcoal is added, and the fire or steam is applied; here it is boiled until

it marks 21° by the saccharometer, when it is passed into a receiver, whence it flows into the clarifiers for purification. During the boiling, if the juice rises in the pan so as to threaten to overflow, a small quantity of tallow* is added, which causes an immediate subsidence, and facilitates evaporation.

21. "*Clarifying.* The clarifiers are wooden or copper pans, 2 feet 8 inches deep, 20 inches diameter at top, 11 inches diameter at bottom, each with a small brass cock near the bottom. A copper strainer standing on three feet and covered with canvass is placed in the bottom of each clarifier, which is then filled with granulated animal charcoal, (about 100 pounds in each pan,) and is covered with another copper strainer and cloth, and then the sirup is permitted to flow upon it until the pan is full.

22. "After it has stood some time, the cock is opened, the sirup is permitted to flow slowly into a cistern, and the pans are refilled as fast as they empty. From the cistern the sirup is pumped into the condenser, for a last evaporation. These clarifiers are emptied of their animal carbon twice in the day, and filled with other, fresh burnt from the kilns.

23. "It is found that some of the saccharine remains in this carbon, it is therefore put up to receive the juice from the defficator as it passes into the first evaporater, by which means the saccharine is extracted; after which, the animal carbon is turned out to be washed preparatory to another

* Butter is preferable.

calcination, whereby it is rendered fit for further use, *ad infinitum*.

24. "*Concentration.* The clarified sirup is evaporated in the condenser to 41°, at which point it indicates signs of fitness for crystallization, which may be known by the usual test; drawing between the finger and thumb, when if the thread break and the end draws up to the finger in a kind of horny substance, it is enough. Another mode is, to blow through the holes of the skimmer, when if the sirup be sufficiently tenacious to form air bubbles and fall to the ground, and on bursting leave a white substance, it is immediately removed from the fire.

CHAPTER XXX.

BEET SUGAR—CONTINUED.

1. "WHAT is the yield of sugar per acre and cost of manufacture, independent of the expense of cultivating the crop? Much contrariety of opinion exists upon this subject. Under favourable circumstances, I have reason to know that 8½ per cent. of sugar has been obtained. This consists of first, second, and third qualities, and leaves only the molasses, which cannot be crystallized by any process now known.

2. "In the estimate of *the cost of the manufacture of sugar*, the profit upon the beet culture must be made to appear, as also the profit arising from the

feeding of cattle and sheep, with the molasses and cakes, and the value of the manure. To this add the profit arising from the preparation of animal carbon, which every extensive manufacturer prepares for his own use, and the value of the seed, which all such are enabled to send to market, and I estimate the cost of sugar to the manufacturer at $4\frac{4}{7}$ sous ($4\frac{1}{2}$ cents) per pound.

3. "What mode of expending the refuse of the sugar house for the fattening of cattle? The cakes are preserved in magazines sunk in the ground, where they are beaten hard and left to ferment. At the end of 6 or 9 months they are cut out in a vinous state and given to cattle and sheep; excellent for the purpose. A sheep will eat 5 pounds of this food (mixed with a small quantity of oilcake, say about 2 pounds for 10 sheep) a day. Cattle, while fatting, eat 75 pounds of beetcake and 6 pounds of oilcake per day.

4. "The molasses is mixed with water and poured upon chopped straw in cisterns, where it remains for 24 hours, when it is given to horses, cattle, and sheep, which devour it voraciously. The sheep pens are strewed with lime instead of straw, a most excellent mode, as it saves straw which might be cut into chaff, and conduces to the health of sheep, as well as to their cleanliness. The lime prevents and cures the foot rot, and is the means of forming a large quantity of most valuable compost, which is applied as a spring dressing to young clovers; the effect is instantaneous. Sheep fatten in 2 months or 60 days.

5. "The cakes from 100 pounds of beet, with a mixture of molasses and straw, are sufficient food

for 3 sheep per day. From 2000 pounds of beet, food for 60 sheep for 1 day; from 1 acre of beet, therefore, food for 60 sheep for 20 days; the cakes from 3 acres of beet, with an allowance of straw and molasses, and the above quantity of oil-cake, are sufficient to fatten 60 sheep for the market.

6. "What kind of cattle, and at what age are they preferred, so as to give the greatest profit for fattening, and the usual time of feeding? Oxen are not put to fatten until five years old, being worked on the farms until that age. Cows fatten well, and all descriptions of cattle are fed in as short a time as upon other customary food.

7. "The sugar which was forwarded, together with the beet seed, was obtained from a refinery at Paris. The samples of unrefined sugar which were delivered, are *bona fide* from the beet, and were procured from the different manufactories which I have visited, and show the various qualities and sorts distinctly.

8. "What crop precedes the beet, and what is the estimated quantity? In many places beet is grown every second year, a crop of grain intervening; in some places every year in succession; a field in the neighbourhood of Arras has borne beet, either as a crop for crushing or for seed, for the last fifteen years. It is sown after every crop, but does best, perhaps, after clover, the land being ploughed in winter and got ready for an early spring sowing. Oats often precede the beet, but in this case it is usual to manure for the beet, the manure buried in drills after the English method.

9. "What crop succeeds it, &c.? Too often wheat, a bad practice. The land should be laid dry for the winter and sown with a spring crop, clover always accompanying it. Such crops are excellent; wheat light and small eared, apt to blight, quantity often not more than 18 or 20 bushels per acre.

10. "Is the crop ever manured for? Yes, after oats, for it is found that manure is not, of *necessity*, injurious to the crop of sugar, as it was once thought to be.

11. "What kind of manure is used, and what effect are different manures supposed to have (if different are used) on the saccharine? An abundant supply is always found in the farmyard, for as the beet is sown as a fallow crop, generally without dung, it throws the usual time for manuring one year back, *an incalculable assistance to the dungheap.* The refuse of the sugar house is reserved as a top dressing to the clovers; bones are too valuable to be used as manure, as they are required for clarifying the sugar: lime not in use except for strewing the floors of the sheep sheds, where it becomes one of the richest and most valuable manures known.

12. "What is the weight of the average crop of beet and grain? Under favourable circumstances and seasons, beet 40,000 pounds per acre, oats and barley 35 to 40 bushels, wheat 25 to 30, or 33 bushels per acre.

13. "Are crops most productive of saccharine on sandy soil, or loam? Light soils are preferred, if they are not of a burning nature. Moisture is necessary to the growth of the beet; but if they

are raised on land with a wet subsoil, they will rot in the winter, although they may appear, at the time of taking up, to be perfectly sound. Deep soils produce large crops, but they are not valued on that account, the small roots often producing more sugar than large ones. No judgment can be formed but by experiment.

14. "What is the rotation of crops? Beet, beet, beet. Beet, wheat, beet. Oats, beet, barley with seeds. What is the price of the best beef, fed from the beet of a sugar house, when compared with beef otherwise fed? Equal, as cattle are never finished with beetcakes alone; an allowance of oilcake does the business more quickly.

15. "How does the use of the refuse of the sugar house affect the produce of the dairy? Good for all kinds of cattle. Cows which give milk must not be fed with fermented cakes, as they communicate an unpleasant flavour to the butter. Molasses, when mixed with water and poured on cut straw or hay, and left for twenty-four hours, is excellent for the purpose.

16. "What are the expenses of conducting a beet sugar manufactory, and what the estimated profits? *The raising of the beet* and the *manufacturing of the sugar* should always accompany each other, and an estimate made of both united would show the result. If the beet is grown, and sold to the sugar maker, the land is robbed of the manure arising from the expenditure of the crop, and although great profits might arise at first from this system, it must in the end prove ruinous.

17. "And if the sugar maker has to purchase his roots for crushing, he often meets with those

which yield but little sugar; he sells the cakes and molasses to those who get his profit upon feeding, and his manure, from the sugar house, for less than a quarter part of its value. I have scarcely met with any one who is contented with his share, if divided, although there are many who are compelled so to act. The perfection of the beet-root culture in France is, when it is joined to the making of sugar.

18. "In the town of Arras, a person has established a sugar house upon a very economical scale, performing much of the labour and superintendence in person; he erected most of the machinery with his own hands; and is a very intelligent man. He rents land, properly prepared, of the farmers in the neighbourhood, for the growth of his crops of beet, at the charge of from 200 to 230 francs per acre; he has no means of feeding sheep with the cakes, and the molasses and manure he sells to those who are making a profit from this branch of his business; it must be a good trade which could bear such weeding; and yet he made 110,000 pounds of sugar last season."

CHAPTER XXXI.

BEST BREEDS OF CATTLE.

1. The Devonshire breed is supposed to have descended directly from the wild race. Its head is small, clean, and free from flesh about the jaws,

deerlike, light and airy in its countenance, neck long and thin, throat free from jowl or dewlap, nose and round its eyes of a dark orange colour, ears thin and pointed, tinged on their inside with the same colour that is always found to encircle its eyes.

2. Horns thin, and fine to their roots, of a cream colour, tipped with black, growing with a regular curve upward, and rather springing from each other. Light in the withers, resting on a shoulder a little retiring and spreading, small, and tapering below the knee, fine at and above the joint, and where the arm begins to increase it becomes suddenly lost in the shoulder. Thin loose skin, covered with hair of a soft and furry nature, inclined to curl whenever the animal is in good condition and in full coat, bright blood red, without white or other spots.

3. The Devon cattle are highly esteemed both for feeding and draught; but are not so much valued for the dairy. For all the purposes of labour, whether activity, docility, or strength, and hardiness, this breed can scarcely be excelled. The ordinary average weight of the oxen, when fatted at five years old, is about eleven hundred, and that of full-sized cows seldom exceeds eight.

4. The Sussex breed differs but little from the Devonshire: when pure, the cattle are invariably dark red; and those which are marked with a mixture of either white or black, although called *Sussex*, are always crossed with foreign blood.

5. The Hereford breed is a variety of the Devon and Sussex, but is larger, broader, and weightier than either. The prevailing colour a

reddish brown, with white faces; the hair fine, and the skin thin. In the true-bred Hereford cattle there is no projecting bone in the point of the shoulder, which in some breeds forms almost a shelf, against which the collar rests.

6. The horn pushes aside a little, and then turns up thin and tapering; remarkably well feeling, and very mellow on the bones. The quality of the meat not hard, but fine as well as fat; little coarse flesh about them, the bone being small in proportion to their weight. Their disposition to fatten is equal, or nearly so, to that of any other breed in the island.

7. They are, however, ill calculated for the dairy; their disposition to accumulate flesh being opposed to the qualities of good milking cows: an observation which will equally apply to every breed, when similarly constituted. A breed of cattle equally adapted to the shambles, the dairy, and the plough, is indeed not to be met with; experience teaches that these properties are inconsistent with each other.

8. The Hereford cattle are by many good judges considered to approach the nearest to that perfect state, of any of the large breeds. They arrive early at maturity, and are fit for labour; but it is as fatting stock that they excel, and it is a different variety of the same breed that is preferred for the dairy.

9. On comparison with the Devon and Sussex, the Hereford breed will probably not be found equally active and hardy in the yoke; but it is generally considered to exceed them in the quality of fattening,

10. The short-horned cattle are more generally known as the Durham or Yorkshire breed. This breed was made known in England about forty years ago, and has rapidly risen in the public estimation. The cattle are very large, and are beautifully mottled with red or black upon a white ground. Their backs are level—throat clean—neck fine, and body full and round.

11. They have a very fine coat, and thin hide. They differ from the other breeds, not only in the shortness of their horns, but in being wider and thicker in their form, and consequently feeding to greater weight: also, in affording the greatest quantity of tallow when fatted; and in having very thin hides, with much less hair upon them than ony other kind except the Alderneys.

12. They also possess the valuable properties of fattening kindly at an early age, and of yielding large quantities of milk. The quality of the latter, however, is not so rich as that of some other species. This breed is now preferred in this country and in England, though the Devonshire makes the best oxen.

13. The Galloway breed are black or dark brindled. They are without horns, except occasionally a small bunch resembling them. They are rather under the medium size, being smaller than the Devons, though in some other respects resembling them.

14. Galloways are a hardy race, subsisting on the coarsest pastures, and increasing rapidly when removed to more favourable situations; they fatten kindly on the best parts. Their flesh is of the finest quality; and the joints being of a moderate

size, more suitable for private families than those of the larger breeds. They are remarkably good milkers; and are well adapted to poor lands.

15. The Ayrshire breed ranks deservedly high in the estimation of dairymen. The head is small, but rather long and narrow at the muzzle—the eye small but quick and lively—the horns small, clear, bended, and the roots at a considerable distance from each other. The neck is long and slender, and tapering towards the head, with little loose skin hanging below—and shoulders thin. The skin is thin and loose—hair, soft and woolly—the head, horns, and other parts of least value, small, and the general figure compact and well proportioned.

16. Such are the chief breeds now in high repute. But it must be admitted, that there are great deviations in many animals of the same, and of the most approved stocks; and there are, besides, many crosses and local breeds distinguished by the name of the district, or the breeder, which it would be tedious to particularize.

CHAPTER XXXII.

THE DIFFERENT BREEDS OF NEAT CATTLE COMPARED.

1. From what has been said, the reader will probably be enabled to form some estimate of the value of the respective breeds of cattle. The two

kinds, however, which are chiefly reared, are the *long-horned* and the *short-horned.* Concerning their merits and demerits, there has long been a difference of opinion among the most experienced breeders. On that subject, therefore, it may not be altogether useless to offer a few comparative remarks for the consideration of the young farmer.

2. The long-horns excel in the thickness and firm texture of the hides, in the length and closeness of the hair, in their beef being finer grained and more mixed and marbled than that of the short-horns, in weighing more in proportion to their size, and in giving richer milk. But they are inferior to the short-horns in giving a less quantity of milk, in weighing less upon the whole, in affording less tallow when killed, in being slower feeders, and of a coarser make.

3. In few words, the long-horns excel in the hide, hair, and quality of the beef; the short-horns in the quantity of beef, tallow, and milk. Each breed has long had, and probably may have, its particular advocates; but, if I may hazard a conjecture, is it not probable that both kinds may have their particular advantages in different situations?

4. Why may not the thick, firm hides, and long, close-set hair of the one kind be a protection and security against those impetuous winds and heavy storms to which the north part of this country is so subject; while the more regular seasons and mild climate, at the south, are most suitable to the constitutions of the short-horn?

5. Further trials of their respective qualities must be accurately made and faithfully recorded,

before an undisputed preference can be awarded to either; for it cannot be concealed that local prejudice is often opposed to fact. The long-horns appear best adapted for grazing; being well protected by thick hides and long hair, and seemingly intended by nature for the range of pasture land.

6. The short-horns, on the contrary, have thin hides and short hair, and being of a more tender constitution than the former, and arriving to greater weight, seem better calculated for the system of stallfeeding; while the Devons have the advantage as working oxen.

CHAPTER XXXIII.

ON BUYING AND STOCKING A FARM WITH CATTLE.

1. The first object of attention to the farmer is to consider the proportion between his stock and the quantity of feed which will be necessary to support them. The nature, situation, and fertility of the soils that compose his farm are worthy of notice; also the purpose for which he designs more particularly to rear or feed his cattle; whether for the pail, or for beef.

2. In fact, it will be expedient to observe the greatest exactness in this proportion, because if he should overstock his land, he will be compelled to resell before the cattle are in a fit state for the market, and, consequently, at certain loss; while, on the other hand, he will incur a loss in his profit,

if he does not stock his land with as many cattle as it will bear.

3. Formerly, a great prejudice prevailed in favour of big-boned, large beasts, but it has been ascertained that this breed is, in point of profit, much inferior to the middle-sized kind. By a careful attention to the selection of stock, great progress may be made towards the improvement of the different species. Among the various professional breeders of modern times, few have attained greater celebrity than the late Mr. Bakewell of England, to whom we are indebted for many new and important improvements in the science of rearing cattle.

4. The principle which he invariably adopted was, to select the best beast, that would weigh most in the valuable joints; so that, while he gained in point of shape, he also acquired a more hardy breed. By attending to the *kindliness* of their skin, he became possessed of a race which was more easily fed and fattened than any other.

5. For many years, the practice was to judge by the eye only, without regarding the other qualities of the animal. But, in the present improved age, a more rational mode of forming the judgment has been adopted. The sense of touch is now brought in aid of the sight. By repeated practice, the art of judging of the kindliness to fatten has been brought to such perfection, that any well-informed breeder will tell, almost instantaneously, in what points or parts they will or will not fatten.

6. In the selection, therefore, of live stock in general, the young farmer will find it necessary attentively to consider the following particulars:

Beauty, or symmetry of shape; in which the form is so compact that every part of the animal bears an exact consistency, while the carcass should be deep and broad, and the less valuable parts (such as the head, bones, &c.) ought to be as small as possible. Further, the shoulders should not only be light of bone, and rounded off at the lower point, but also broad, and well covered with flesh. The back also ought to be wide and level throughout.

7. In *rearing live stock* of any description, it should be an invariable rule to have the increase from small-boned, straight-backed, healthy, clean, kindly skinned, round-bodied, and barrel-shaped animals.

8. In the *purchasing of cattle*, whether in a lean or fat state, the farmer should on no account buy beasts out of richer or better grounds than those into which he intends to turn them. For, in this case, he must inevitably sustain a very material loss, by the cattle not thriving, particularly if they be old. It will, therefore, be advisable to select them, either from stock feeding in the neighbourhood, or from such breeds as are best adapted to the nature and situation of the soil.

9. *Docility of disposition*, without being deficient in spirit, is of equal moment. Independently of the damage committed by cattle of wild tempers on fences, fields, &c., it is a fact, that *tame beasts require less food to rear, support, and fatten them:* consequently every attention ought to be paid, early to accustom them to be docile and familiar.

10. *Hardiness of constitution*, particularly in bleak and exposed districts, is indeed a most important requisite. In every case it is highly es-

sential to a farmer's interest to have a breed that is liable neither to disease nor to any hereditary distemper.

11. Connected with hardiness of constitution is *early maturity*. This, however, can only be attained by feeding cattle in such a manner as to keep them constantly in a growing state. By an observance of this principle, it has been found that beasts and sheep thrive more in three years, than they usually do in five when they have not sufficient food during the winter. In the common mode of rearing, their growth is checked.

12. *Working*, or an aptitude for labour. Whether kine be purchased for the plough or for the purpose of fattening, it will be necessary to see that they are young, in perfect health, full mouthed, and not broken in any part. That the hair stare not, and that they are not hidebound, or they will not feed kindly.

13. The same remark is applicable to cows intended for the pail. Their horns should be fair and smooth, the forehead broad, udders white, yet not fleshy, thin and loose when empty, (to hold the greater quantity of milk,) but large when full.

14. Beside the rules above stated, there are some particulars with regard to the *age* of cattle and sheep, which merit the farmer's consideration. Neat cattle cast no teeth until turned two years old, when they get two new teeth; at three they get two more; and in every succeeding year get two, until five years old, when they are called *full mouthed* Though they are not properly full mouthed until six years old, because the two corner teeth, which

are last in renewing, are not perfectly up until they are six.

15. The horns of neat cattle also supply another criterion by which the judgment may be assisted, after the signs afforded by the teeth become uncertain. When three years old, their horns are smooth and handsome; after which period there appears a circle, or wrinkle, which is annually increased as long as the horn remains; so that, according to the number of these circles or rings, the age of a beast may be ascertained with tolerable precision.

16. Sometimes the wrinkles are defaced, or artificially removed, by scraping or filing. This is a fraudulent practice, too frequently adopted, in order to deceive the ignorant or inexperienced purchaser, as to the real age of the animal. These circles, however, must not be confounded with the ringlets which are sometimes found at the root of the horn, and which are a pretty sure indication that the animal had been ill-fed during its growth.

CHAPTER XXXIV.

THE COW.—RAISING CALVES.

1. A PERFECT *breeding cow* ought to have a fine head, with a broad, smooth forehead; black eyes; clean horns, and a smooth, elastic skin.

2. Cows are purchased either with a view of

being fattened for sale, for breeding, or for the purposes of the dairy. If for beef, it will be advisable to attend to the kindliness of their skins, and disposition to fatten. With regard to those which are intended for breeding, care should be taken to select the best of that particular stock intended to be raised; and for the dairy, those which yield the most, and the richest milk. The last subject will be treated more at large under that head.

3. The desirable qualities of a dairy cow are, that she should give an abundant supply of milk; fatten readily; and turn to good account in the shambles. But, in fact, those beasts which yield great quantities of milk seldom fatten quickly. There is, it is true, a middling kind of cows, which give a tolerable quantity of milk, and also keep in pretty good condition.

4. But, though many of this sort will become very fat when they are dried, or their milk is taken from them, yet they will not fatten so speedily or so well as those which yield a less portion of milk, and which are more kindly disposed to fatten while they are in a milking state.

5. As, however, the dairy constitutes, in many parts of this country, an object of great importance, it is a point worthy of the most deliberate consideration, whether a particular breed ought to be kept for that purpose only, or whether it be preferable to have stock calculated partly for the butcher, and partly for the dairy.

6. "It is probable," observes Sir John Sinclair, "that, by great attention, a breed might be reared, the males of which might be well calculated, in

every respect, for the shambles; and the females of which might, when young, produce abundant quantities of good milk; yet, when they reached eight or nine years of age, might be easily fattened. This," he justly remarks, "would be the most valuable breed that could be propagated in any country; and, indeed, some of the best English and Scottish breeds have almost reached that point of perfection."

7. There are two modes of feeding calves:—one is, to permit them to run about with the parent cow the whole of the first year; and the other mode is, to wean them when about a fortnight old, and bring them up by hand. The former expedient is generally allowed to be productive of the best cattle, and is adopted in those countries where fodder is abundant and cheap. In others, where it is found prudent to reserve a portion of the milk, the latter plan is pursued.

8. Whether calves are designed to be raised for breed, labour, or feeding, care should be taken that they have a sufficient supply of good pasture. If this be scanty at first, they rarely, if ever, attain to large growth. Various plans have been suggested, and tried with considerable success, for rearing calves without any, or at least with a small quantity of milk. The time of separating them from the parent cow varies, from one fortnight till they are seven weeks old; but the latter period is preferable, on account of the weak state of the calves, if separated from the dam at an earlier age.

9. In winter the calves may be fed with lukewarm skimmed milk and water, having bran or

oats in it, and some very sweet hay by them, till the grass is ready. If the farmer have carrots, they form an excellent article of food, and render the use of oats unnecessary. About three gallons of milk daily are sufficient for the support of a calf until he begins to eat. It should be given regularly at the same hours; and he should be kept as quiet as possible, as rest is found to promote his growth.

10. Some feed partly with meal mixed in the milk after the third or fourth week; or gradually introduce some new whey along with the meal, and afterward withdraw the milk altogether. Hay tea, flaxseed jelly, &c., are also sometimes used with advantage. But milk, when it can be spared, is by far the best as well as the most natural food. Another mode of rearing calves has been suggested to render the use of new milk unnecessary, while the expense is reduced in the proportion of two thirds.

11. It is effected in the following manner: Let half an ounce of common molasses be well mixed with a pint of skimmed milk, then gradually add one ounce of finely powdered flaxseed oilcake, stirring it till the mixture be properly made, after which it is to be added to the remainder of a gallon of milk. The whole, being made nearly of the temperature of new milk, may then be given to the animal. After a short time, the quantity of pulverized oilcake may be increased. This method is said to have been advantageously adopted.

12. An infusion of hay tea or hay water has been also applied to the purpose of rearing calves

with the smallest quantity of milk. In order to make this infusion, such a portion of fine, sweet hay, cut once or twice, is put into a small earthen vessel as will fill it. The vessel is then filled with boiling water, and carefully closed; at the end of two hours a brown, rich, and sweet infusion will be produced, not unlike alewort, or strong tea, which will remain good for two days.

13. In the rearing of calves, much, however, depends on the regularity of feeding them. The common practice is, to supply them with food twice in the day, in the morning and at evening. Then they generally receive as large a quantity as their craving appetites can take. Hence the digestive organs are necessarily injured, and numerous animals either become tainted with disease, or perish from the inattention of their keepers. When, by feeding them thrice in the day, at equal intervals, and allowing sufficient room for exercise, (when they are not intended to be fattened,) they will not only be preserved in health, but they will also greatly improve in condition.

14. Whatever food be allowed to young calves, care should also be taken not to change it too suddenly. A calf must have attained a certain degree of strength before it can dispense with the food most natural to its age. It should always, therefore, be allowed as long as possible. It is a common notion that provided young stock acquire size, their condition is immaterial; and, after the first winter, they are generally turned into the toughest pasture, and kept during the following winter on straw, with, perhaps, a little indifferent hay.

15. But they should be kept on good pasture during the summer, and allowed roots with some sound hay in the winter, and green food in the spring; a contrary mode, though the most economical, is decidedly disadvantageous; for the worst breed will ultimately be improved by good feeding, while the best will degenerate under a system of starvation.

16. With regard to those calves which are intended for the draught, it will be advisable to accustom them, while young, to be handled and stroked, and tied up to the manger; as they may, when they come to be broken in, be handled with less apprehension of danger.

CHAPTER XXXV.

WORKING OXEN.

1. A good ox for the plough should be neither too fat nor too lean. In the former case, he will be lazy; and in the latter, he will be weak and unfit for labour. His body ought to be round, joints short, legs strong, eyes full, his coat smooth and fine, and every part well put together, so that his strength may be easily seen. Another requisite is, that he may answer to the goad, and be obedient to the voice; but he can only be governed by gradual use and gentle treatment.

2. Calves designed for the yoke should not be broken in earlier than two and a half or three

years, lest they be overstrained; nor should that operation be deferred longer, as they will become headstrong or stubborn. Their work should then be so proportioned as not to affect their growth, which continues till about their seventh year. If this be not attended to, their value will be lessened in a greater degree than will be compensated by their labour.

3. The strength of this animal, when properly trained and managed, is very great. He has patience to endure fatigue; but, being naturally slow, he must not be urged beyond his usual pace. The only method by which success can be attained is, by patience, mildness, and even by caresses; for compulsion and ill treatment will irritate and disgust him.

4. Hence, great assistance will be derived from gently stroking the animal along the back, by patting him, and encouraging him with the voice, and occasionally feeding him with such aliments as are most grateful to his palate. When he has thus become familiar, a yoke may be put upon his neck, when he should be fastened to a plough with a tame old ox, of equal size.

5. Next, the oxen should be employed in some light work, which they may be suffered to perform easily and slowly; thus they will draw equally, and the young steer will be gradually inured to work. After working in this manner, he should be yoked with an ox of greater spirit and agility, in order that the steer may learn to quicken his pace. By thus frequently changing his companions, as occasion may allow, he will, in the course of the first month or six weeks of his la-

bour, be capable of drawing with the briskest of the stock.

6. Another circumstance of essential importance in breaking-in young oxen is, that, when first put to work, they be not fatigued or overheated. Till they are thoroughly trained, therefore, it will be necessary to employ them in labour only at short intervals—to indulge them with rest during the noonday heats of summer, and to feed them with good hay, which, in this case, is preferable to grass.

7. In fact, while oxen are worked, they must be kept in good condition and spirits, by moderate, but wholesome sustenance. Further, on their return home from labour, it will greatly contribute to preserve their health if their feet be well washed previous to leading them into their stalls; otherwise diseases might be generated by the dirt adhering to them; while their hoofs, becoming soft and tender, would necessarily disable them from working on hard or stony soils.

8. The extremes of heat and cold ought also to be carefully guarded against, as disorders not unfrequently arise from excess of either temperature; and they are peculiarly exposed to fevers and the flux, if chased or hurried, especially in hot weather.

9. Farmers, generally, exercise but very little skill in managing oxen. They run ahead of the cattle and cry "Come along;" and then run back to them and give them a cut or two, and then walk on ahead of the cattle again. By such driving, the oxen are made very slow.

10. The driver should walk by their side and

close to them. He should accustom them to walk fast, and encourage them by his voice, and not break their spirits by pounding them with a large pole, as is frequently done.

CHAPTER XXXVI.

PASTURING CATTLE.

1. The feeding and fattening of cattle, whether for labour or for sale, is the most important in the whole economy of the grass farm. Hence the farmer should previously consider the *nature* and *fertility* of his *pastures*, and the extent and quality of his other resources. According to these, he ought to regulate his system of *grazing*, *soiling*, or *stallfeeding*.

2. He should then select those beasts only which evince the most *thriving disposition to fatten with the least consumption of food*, and pasture them upon such lands as are best calculated for the respective breeds. He should not take cattle from rich to inferior soils, but, wherever it is practicable, choose them from lands of nearly the same quality as those destined for their reception. It is also proper in all situations which are not provided with wholesome water, to avoid selecting cattle from those districts where it abounds in a state of purity.

3. In order to graze cattle to advantage, it will be profitable to change them from one pasture to

another; beginning with the most inferior grass, and gradually removing them into the best. By this expedient, as cattle delight in variety, they will cull the choicest part of the grass, and by filling themselves quickly, they will rapidly advance towards a proper state of fatness.

4. The grass which is thus left may be fed off with labouring cattle, and lastly with sheep. Hence it will be advisable to have several enclosures, well fenced and sheltered, and abundantly supplied with wholesome water. Respecting the best size for such enclosures, there is a difference of opinion. From four to eight acres, perhaps, is the most appropriate; though, if any be of a greater extent than this, they may be divided by a temporary fence for this purpose.

5. Thus the greatest and strongest cattle will be separated from the weaker ones. For, if cattle of various sizes are mingled together, the more powerful beasts will master the others, driving them from place to place, and trampling upon or wasting more food than they can eat.

6. In the grazing of cattle, a variety of circumstances will claim the farmer's attention, in order to conduct his business either with regularity or profit. He ought to take especial care not to turn his stock out into the pastures in the spring, before there is a *full bite*, or the grass has obtained a sufficient degree of length and maturity.

7. Where beasts are turned into fields, great circumspection is required, to see that they do not eat to such excess as to become *blown* or *hoven*. That disorder, however, may be prevented, either by feeding the animals so as to gratify the cravings

of appetite before they are turned into the pasture, or by constantly moving them about the field for a few hours after they have been turned in. Should they, notwithstanding, be attacked with that dangerous swelling, they may be relieved by adopting the remedies pointed out in the chapter of diseases.

8. The *hard* or *light stocking of pasture ground* is a point on which many experienced graziers are by no means agreed. By some, it is contended that pastures ought to be stocked very lightly. They say, that although much of the produce is thus allowed to run to seed, which the cattle will not eat, and is trodden under foot, and thus wasted, yet experience, say the advocates for *light stocking*, evinces that a greater profit will, upon the whole, be thence derived than by any other practice on account of the superior thriving of the animals.

9. By others, it is maintained that the practice of light stocking is to be condemned. They say it not only tends to diminish the produce of the fields, but also to encourage the growth of coarse and unprofitable grasses. They contend that the *hard stocking* of grass lands, particularly those of a rich quality, is indispensable to good management.

10. It is recommended by a third party, that *mixed stock* should be always kept on the same field. The foul grass produced by the manure of some animals will then be consumed by others. And as it is well known that different species of cattle prefer different kinds of grass, there is an evident advantage in this practice.

11. In every field, plants spring up, some of which are disliked by one class of animals, while they are eaten by others. Hence, it becomes necessary to have a great variety of cattle in the same pasture.

12. On this, it is however to be observed, that where a great variety of animals are allowed to go at large in the same pasture, they rarely feed with that tranquillity which is necessary to ensure thriving. It frequently happens that one class or sort of beasts wishes to feed or to play, while others are inclined to rest.

13. Thus they mutually tease and disturb each other; and this inconvenience is increased, if any sort of *penning* or confinement be attempted. Hence it is obvious, that the practice of intermixing various kinds of live stock is productive of evils, which are, in many instances, greater than those resulting from the waste of food intended to be prevented by this practice.

CHAPTER XXXVII.

SOILING CATTLE.

1. Soiling simply means cutting the grass in summer and feeding the cattle, instead of letting them run in the field. By introducing the practice of soiling, *a very considerable saving of land* will be effected, one acre of cut grass soiled being equal to three acres used as pasture; and one acre of cut clover being equal to two acres pastured.

In this case the clover is not trampled upon, and grows much faster than if it were often corroded with the teeth of an animal, or the young leaves nibbled off before they are sufficiently formed.

2. It has even been affirmed that *sixteen* acres of cut clover and tares will feed as many horses and cattle as *thirty-six* acres of the same kind of grass would do if used in pasturage. As all plants draw much of their food from the atmosphere by means of their foliage, they are deprived of their chief support and never attain perfection, if the herbage be trodden before it has arrived at maturity.

3. There is also a very *considerable saving in the quantity of food consumed*, as well as a greater variety of plants eaten. When animals are suffered to go upon the field, many plants are necessarily trodden under foot and bruised, or partly buried in the earth. In this state they are greatly disrelished by cattle, and are suffered to run to waste.

4. This circumstance never could occur, if the practice of cutting were adopted. Cattle also will eat with avidity many plants, *if cut and given to them in the house*, which they never would touch while growing in the field: such are the dock, cow parsley, thistles, nettles, and numerous other plants.

5. As to the influence of soiling on the *health and comfort of cattle*, the balance is conceived to be in favour of the cutting system, when compared with that of pasturing. Thus, they are not liable to be blown or hoven, or to be staked or injured by breaking fences. And it is well known that when

animals are exposed to the sun, in the open air, they are not only greatly incommoded on many occasions by the heat, but are also annoyed by swarms of flies, gnats, and hornets, which obviously tends to impede their thriving.

6. At other times they are hurt by chilling blasts, or drenched by cheerless rains. Under proper management, in well-constructed stalls, all these evils would be removed, and they would be kept in a uniform state of coolness, tranquillity, and ease. Lastly, by judiciously mingling green vegetables with dry food, as circumstances may require it, and by varying the different articles so as to provoke appetite, not only the health but also the thriving of the creatures will be greatly augmented beyond what they could be by any other mode of treatment.

7. The proportionate increase of manure obtained by soiling and stallfeeding further evinces their superiority over pasturing. *Manure* is the life and soul of husbandry. And there can be no doubt that the quantity of manure made during the summer may be made to equal the *produce* during the winter. The *quality* must depend on the nature of the food.

8. As to the *quantity of herbage* afforded from the same field, under the *cutting* and *grazing* systems, the balance will be found equally in favour of the former. All animals, it is well known, delight more to feed on the young and fresh shoots of grass than on such as are older. Hence it invariably happens, that those patches in pastures which have been once eaten bare, in the beginning of the season, are kept very short during that

season, by the animals prefering them to other parts of the field where the grass is longer; so that the latter are often suffered to continue in a great measure untouched.

9. Another circumstance, which is not generally known, is, that grass, when it has attained a certain length, becomes stationary. Notwithstanding it will retain its verdure in that state for some months, yet, were it cut, it would continue in a constant state of progress, proportioned to the frequency of its being cropped. Experiments have, indeed, been brought forward to prove that with clover, rye grass, lucerne, and tares, *double the number* of cattle may be supported in much better condition, when cut, than when pastured.

10. Many exaggerated statements have been produced in support of the system of soiling: but, without attaching implicit faith to these, we are convinced, that, by judicious management in this respect, the profits of the grazier may be largely augmented.

11. The following facts and conclusions are undoubtedly true. A spot of ground which, when pastured upon, will yield sufficient food for only *one* head, will maintain *three* head of cattle in the stable, if the vegetables be mowed in proper time, and given to the cattle in a proper order.

12. The stallfeeding yields at least double the quantity of manure from the same number of cattle. The best and most efficacious manure is produced in the stable, and carried to the fields at the proper period of its fermentation. Whereas, when spread on the meadow, and exhausted by the air and sun, its power is almost wasted.

13. The cows used to stallfeeding will yield a much greater quantity of milk, and increase faster in weight, when fattening, than when they go into the field. They are less subject to accidents, do not suffer by the heat, by flies and insects, and if everything be properly managed, they remain in a constant state of health and vigour.

14. The stalls may be so constructed as to admit a regular circulation of air, and yet shelter them from the attacks of flies. The cattle may also be allowed the freedom of an open yard. Indeed, in that season, *foldyards*, with open sheds, are much to be preferred to stalls. This is the practice in England, where the management of stock is well understood.

15. Air is, indeed, indispensably necessary to the preservation of the health and the speedy fattening of animals. If they are kept too hot, they will perspire profusely, and their hides will itch: this vexes them and necessarily retards their quick feeding. When grass is to be given, it ought to be cut in the morning for the evening food, and in the afternoon for the morning. The afternoon crop should be carried to the barn, or some other convenient place, and spread out in order to exhale its superfluous moisture.

16. In the early part of the season, when grass is scant, it may be mixed with the hay or straw on which the cattle are fed. If the mixture be made up over night, the dry provender will be found to have acquired a sweet vegetable taste, and to be rendered so moist and palatable as to be more readily eaten.

CHAPTER XXXVIII.

STALLFEEDING BEEF CATTLE.

1. PARSNIPS are employed not only for feeding store cattle, but particularly for fatting oxen. This flesh is considered superior to any other beef, and commands an additional price.

2. Next to parsnips we may class the *carrot*—a most useful root. Mangel-wurtzel comes next in order in feeding cattle: indeed, in some late experiments it has been found superior to carrots, and nearly equal to parsnips. *Turnips*, especially rutabaga, also supply a nutritive article for food.

3. These roots may be fed or thrown on the land in the following manner. A cart enters a field, in which stands a boy, who, as the vehicle is going along, throws the roots out, with their tops and stems on, as they are drawn out of the ground.

4. The *second method* of giving these roots to cattle is by means of close bins, while the beasts are kept in a loose strawyard. The tap root, and also the tops, unless they are fresh and palatable, should be previously cut off, so that the fatting animals receive only the bulb. The tops, if eatable, may be consumed by store cattle.

5. The *third method* consists in keeping the cattle tied up in open sheds, with mangers for receiving the roots. The roots may be cut into pieces, which will make them more palatable.

6. In autumn, while the weather continues moderate, the beeves may be allowed to remain abroad. But whenever it sets in very wet, or becomes intensely severe, they should be kept under shelter, either until their fattening is completed, or the warmth of spring again invites them abroad.

7. Among the various vegetable productions that have been appropriated to the stallfeeding of cattle, none have occasioned greater discussion than *potatoes*. They furnish an excellent supply when cut and steamed, and appear adequate to the fattening of cattle, in connection with a small portion of other food.

8. These roots should, at first, be given in small quantities, which should be gradually increased to one or two bushels per day, dry food being always intermixed, and the proportion of hay being regulated by the effect which the potatoes produce on the bowels. There ought to be at least *five servings* in the day. According to the quantity of roots which a beast can be induced to eat with appetite, he will fatten the sooner, of course with less expense and more profit. The potatoes need not be cut, except at first, in order to entice the beasts to eat them; but they ought always to be *fresh* and *clean*.

9. Flaxseed, when mixed with a due proportion of hay or meal, affords an excellent composition for stallfeeding and fattening. It is prepared in the following manner: To seven parts of water let one part of flaxseed be put, for forty-eight hours; then boil it slowly for two hours, gently stirring the whole lest it should burn. Afterward cool it in tubs, and mix it with meal, bran,

or cut straw, in the proportion of one bushel of hay to the jelly produced by one quart of flaxseed, well mashed together. This quantity given daily, with other food, will forward cattle rapidly; but it must be increased when they are intended to be completely fattened.

10. With regard to oxen used in draught, it should be observed, that they ought to be well fed, while they are kept in constant employ, particularly in the commencement of spring and in autumn, when their labour is most wanted. During those seasons, they should be supplied with abundance of cut hay, and with an allowance of a bushel or two of steamed patatoes, turnips, or carrots, per day.

11. If the labour be unusually severe, a moderate quantity of oats should be allowed. Some farmers endeavour to support working oxen on hay alone, and the possibility of this is one great argument used in favour of their employment; but it will be generally found to injure them in a greater proportion than the saving in food.

12. But whatever articles of food may be used, they ought to be given with as much regard to *regularity of time and quantity* as is practicable. If a small part be at any time left unconsumed, it should be removed before the next feed is given, otherwise the beast will loath it. In stallfeeding, it is too common a practice to give a certain allowance, every day, without regard to any circumstance. But it is a fact, that a fattening beast will eat with a keener appetite on a cold day than in warm, damp weather. Hence his food ought to be proportioned accordingly.

13. By giving the same quantity every day, the animal may be cloyed; thus his appetite becomes impaired, the food is wasted, and several days will necessarily elapse before he can recover it. At least three periods of the day, as nearly equidistant as possible, should be selected, when such an allowance should be given to each animal as he can eat with a good appetite; which point can be regulated best by attending duly to the state of the weather, or season, and the progress he makes in flesh. As he fattens, his appetite will become more delicate, and he will require more frequent feeding in smaller quantities.

CHAPTER XXXIX.

MILCH KINE.

1. Red cows have been long celebrated for the excellence of their milk; and the calves of black cows have been proverbially deemed good. But colour in this respect is a matter of no moment; the *breed* alone should claim the farmer's attention. Yet cows even of the same breed will not always yield the same quantity of milk; and of those which yield the most, it is not unfrequently deficient in richness.

2. Trials are easily made, by keeping the cows on the same food, weighing the quantity consumed by each, and measuring their milk. Then keeping and churning it, a few times, separately. Thus,

reckoning the cost of the provender, and the produce of the milk of each, and comparing the result, it will be soon discovered which is the most profitable animal. Comparisons of this kind are not often made; for farmers usually purchase whatever stock they can most conveniently or most cheaply lay their hands on; and are then content to keep them so long as they turn out tolerably well.

3. This is the height of bad economy; for an indifferent cow will eat as much and require as much attendance as the best; and thus occasions a daily loss, that will soon exceed the saving in the original price. The man who takes the pains to acquire a good stock, and has the sense to keep it, lays the sure foundation of a fortune.

4. It will be found, that those cows which yield least in quantity have the richest milk. Yet both quantity and quality constantly vary, even in individuals of the same breed, age, and appearance, and are always affected by the mode of feeding. When kept on old meadow, the butter will have a better flavour than when the cows are fed on artificial grasses.

5. Grains, cabbages, turnips, and other succulent roots will increase the quantity of the milk, yet hay and corn will add most to its richness. Lean cows never yield either so much or so good milk as those which, without being actually fat, are kept in proper condition.

CHAPTER XL.

THE PASTURE AND OTHER FOOD BEST FOR COWS, AS IT REGARDS THEIR MILK.

1. As the nature of the grass has a very considerable influence on the quality and quantity of milk which cows produce, the attention of the thinking farmer will be directed to this point. Instances have occurred, where *six* cows, fed on some pastures, have yielded as much milk as *nine*, or even a *dozen*, will afford on inferior ground.

2. It is obviously his interest to have his cows well fed, rather than to keep up a particular number, without heeding whether they are properly supplied or not. Hence, it will be proper to suit the milch cows to the nature and fertility of the soil; and on no account to purchase them from pastures superior to those destined for their reception.

3. To obtain an abundant supply of good milk, it is not alone requisite that the grass be plentiful, but also that it be of that quality which is relished by the cattle. The long, rank grass, growing in orchards or other places, in general feeds well, and produces a flush of milk. Yet such milk will neither be so rich, nor carry so much cream in proportion, as the milk of those cows which are fed upon short fine grass; nor, of course, will the butter be so good.

4. The quality and quantity of milk are materially affected by driving them to a distance from

the house to the pasture; hence it will be proper to have the cowsheds in as central a part of the farm as possible.

5. In the management of cows, it is essential that they be at all times kept in high health and good condition. If they are suffered to fall in flesh during the winter, it will be impossible to have an abundant supply of milk by bringing them into high condition in the summer. Hence, if cows are lean in the spring, no subsequent management can bring them to yield, for that season, anything like the quantity they would furnish if they had been well kept during the winter.

6. Farmers cannot be easily persuaded to afford high feeding to unproductive stock; nor is that requisite for cows that are dry; but the common practice of keeping them during that period on straw alone, or on the worst hay, is very improvident. During that inclement season, some nutritious food should be provided for them, and the animals be kept moderately warm.

7. Beasts will thrive more, and yet not eat so much, when kept warm, as when they are shivering with cold. When fed on straw, or coarse hay, without any green food, till towards spring, their milk vessels become dried up, and they will not afterward yield either much milk, or of good quality, until they are turned out to pasture. The milk of lean cows is always thin, and as deficient in quantity as nutriment.

8. For this purpose, a small quantity of any of the succulent roots will be found sufficient in addition to their usually dry food. Even a very few Swedish turnips in a day will be found essentially

useful in preventing costiveness, binding of the hide, and the drying up of the juices.

9. In Holland, where it is well known that the management of cows is carried to the highest perfection, they are curried in the same manner, and kept as clean, as horses in the stable.

10. It has already been intimated, that the best summer food for cows is good grass. Additions to hay for winter food are those most commonly employed for fatting cattle—*parsnips* and *carrots*, which roots not only render the milk richer, but also communicate to the butter made from such milk a fine colour, equal to that produced by the most luxuriant grasses.

11. The *mangel-wurtzel*, in Europe, is preferred to every other vegetable for feeding cattle in general. On *potatoes* cows will thrive well, so that with one bushel of these roots, together with soft meadow hay, they have been known to yield as large a quantity of sweet milk, or butter, as they usually afford when fed on the finest pastures.

12. *Turnips*, the utility of which is too well known to require any particular detail here, are apt to impart an unpleasant flavour to butter, unless great care be taken to remove all the decayed leaves. Also, *flaxseed jelly* and *grains*. By the judicious use of these various articles, together with a due admixture of dry food, the quality of the milk is very materially improved.

13. Salt should become an object of serious attention to every one engaged in husbandry. Some of the advantages of its application to stock may be thus enumerated: It restores the tone of the stomach when impaired by excess in other food, and

corrects the crudity of moist vegetables and grasses in a green state.

14. It helps digestion, keeps the body cool, by which many disorders are prevented; and it destroys botts. It renders inferior food palatable; and is so much relished by cattle, that they seek it with eagerness, in whatever state it may be found. When given to cows, it increases the quantity of their milk, and has a material effect in correcting the disagreeable taste it acquires from turnips.

CHAPTER XLI.

THE MANAGEMENT OF MILK AND CREAM—MAKING AND PRESERVING BUTTER.

1. It is necessary to be very cautious in choosing milkers. If a cow be roughly handled, it is not only painful to her, but will also cause her to withhold her milk. If it be gently drawn, she will yield it freely. And it is of importance that it be drawn to the last drop, for it will otherwise decrease at each succeeding milking.

2. It is well to feed the cows at the time of milking, for while eating they give out their milk with greater freedom. They are also prevented, by the motion of their jaws, from the common and very pernicious trick of withholding their milk; by which, if not promptly prevented, they will soon become dry.

3. In this country, it is the general practice to milk cows twice in the course of twenty-four hours; but in summer the proper periods are at least three every day, and at intervals as nearly equidistant as possible. Very early in the morning, at noon, and a little before the approach of night. For it is said to be a fact, that cows, when milked thrice in the day, will yield more milk in point of quantity, and of as good, if not better quality, than they will under the common mode of milking only in the morning and evening.

4. After the milk is drawn from the cow, it should be carefully strained into the cream dishes, which should never exceed three inches in depth, and which ought to be perfectly clean, sweet, and cool. If any ill flavour is apprehended from the cows' having eaten turnips, &c., the addition of one eighth part of boiling water to the milk, before it is poured into the dishes, will, in a great degree, remove it; and, when filled, the dishes ought to be set upon shelves, there to continue till the cream is removed.

5. It should also be observed that the milk first drawn from a cow is always thinner and inferior in quality to that afterward obtained; and this richness increases to the very last drop that can be drawn. The portion of cream rising first to the surface is richer in point of quality, and greater in quantity, than that which rises in the second equal space of time, and so of the rest; the cream continually decreasing, and growing worse than the preceding.

6. Thick milk produces a smaller proportion of cream than that which is thinner, though the cream

of the former is of a richer quality. If thick milk, therefore, be diluted with water, it will afford more cream than it would have yielded in its pure state, though its quality will at the same time be inferior.

7. Milk carried about in pails, or other vessels, agitated and partly cooled before it be poured into the milk pans, never throws up such good and plentiful cream as if it had been put into proper vessels immediately after it came from the cow. From these fundamental facts, some important inferences, serving to direct the practice, may be deduced, among which we can only notice the following:—

8. It is of much importance, that the cows be always milked as near the dairy as possible, to prevent the necessity of carrying and cooling the milk before it is put into the dishes. And as cows are much hurt by far driving, it must be a great advantage in a dairy farm to have the principal grass fields as near the dairy homesteads as possible.

9. The practice of putting the milk of all the cows of a large dairy into one vessel, as it is milked, there to remain till the whole milking be finished, before any part is put into the milk pans, seems to be highly injudicious. There is a loss sustained by the agitation and cooling, and the owner of the dairy is prevented from distinguishing the good from the bad cow's milk, so as to enlighten his judgment respecting the profit that he may derive from each.

10. If these pans were labelled with the cow's name, the careful dairyman would be enabled to remark, without any trouble, the quantity of

milk afforded by each cow every day, as well as the peculiar qualities of the milk.

11. A small quantity of clear water, cold in summer and warm in winter, put into the bottom of the milk pan, will be found to assist the rising of the cream; but it is thought by some persons to be prejudicial to the butter.

12. If it be intended to make butter of a *very fine quality*, it will be advisable to reject entirely the milk of all those cows which yield cream of a bad quality. Also, in every case, to keep the milk that is first drawn from the cow, at each milking, entirely separate from that which is got last. It is obvious, that if this be not done, the quality of the butter must be greatly debased, without much increasing its quantity.

13. It is also obvious, that the quality of the butter will be improved, in proportion to the quantity of the last-drawn milk which is used. Those who wish to be singularly nice, will do well to keep for their best butter a proportion only of the *last-drawn milk;* in like manner of the *first-drawn cream.*

14. Milk consists of three component parts, blended into one, and distinguished as *butyraceous*, or oily substance, of which butter is composed; *caseous* matter, from which cheese is formed; and *serum*, or whey. To separate these is the chief object of the dairy. With regard to butter, two different modes have been adopted: the one, from the *cream alone;* the other, from the *milk and cream united.* The former operation is thus performed.

15. The milk is carefully skimmed by means

of a skimming dish, and the cream poured into a vessel, till enough is obtained for churning. When the cream has been collected, it should be put into a deep, covered vessel, for the action of the air on the surface dries it. It should be well stirred with a stick or spoon once or twice a day.

16. The time of keeping depends on the weather. If the cream from each milking be kept separate, it may remain a week without being injured; but if sweet cream be mixed with that which is sour, they ferment and soon become sour. It is far better to keep the cream from every milking apart, and thus allow each to become sour of itself. The contrary practice should never be adopted, unless it be intended to churn the moment the whole mass has become acid.

17. With respect to the *operation of churning*, we would particularly remark, that it ought to be regularly continued, till the butter is *come*. If the motion be, in summer, too quick, the butter will, in consequence, ferment, and become ill tasted; and, in winter, it will *go back*. In hot weather, the business of churning may be much facilitated by immersing the churn about one foot deep into a vessel of cold water, and continuing it there until the butter is made.

18. It is hurtful to the quality of the butter to pour much cold water on it during this operation. If the butter is too soft to receive the impression of the mould, it may be put into small vessels, and these be permitted to float in a tub of cold water beneath the table, *without wetting the butter*, which will soon become sufficiently firm. Or, when but-

ter is first made, after as much of the milk has been got out as possible, it may be thinly spread on a marble slab, and the remaining moisture be absorbed by patting it with clean dry towels.

19. Water is well known to be a great dissolvent; at least, if it be not essentially so, it serves as a conductor to air, which is universally such. Fresh butter, then, in consequence of imbibing water, and water being saturated with air, is always in a progressive state of decay.

20. Not so when water is excluded: its oleaginous parts are admirably calculated to secure it from putrefaction, and it is not improbable that butter might be made with as little trouble as in the present method, to keep the whole year fresh and sweet, with the least particle of salt, solely by the exclusion of water. In order to effect this, the floor of the dairy should be kept perfectly dry, for water thrown down in hot weather will assuredly rise again in vapour, and affect the milk with its humidity.

21. The vessels used for holding the milk, the churn, and all the dairy utensils, after being first washed clean, should then be rinsed a first and second time with sweet milk—a cruet, washed ever so clean with water, will cause vinegar to become dreggy; but if rinsed with a little of the same, will always appear limpid and clear. No water to be put in with the cream when it is churned.

22. The butter, as it is taken out, to be put into a tray, full of holes, and placed over any other vessel; but not to be squeezed into lumps, as it will drain the better for being loose in its texture.

It should then (after having well drained) be removed to a tray without holes, and be kneaded with the hands (first rinsed in whey) and formed into a thin flat cake, slightly sprinkled with salt, and left in that state for about half an hour; by which time the salt will have extracted the whey, and it may be made up in the usual manner.

23. Butter thus freed from the remaining milk is called *fresh butter;* and, when sold on the spot or in neighbouring markets, it is formed into rolls weighing a pound, or more. But where it is intended to be kept, or sent to a distance, it is salted and put into casks, usually denominated half firkins, firkins, and tubs.

24. Previous to putting the butter into these vessels, especial care must be taken that they be well seasoned by frequent washing and exposure to the air for two or three weeks. As it is very difficult to season new firkins, it will always be preferable to employ those which have been already used where they can be returned to the dairy owner.

25. The most speedy method of seasoning firkins is, by the use of unslacked lime, or a large quantity of salt and water well boiled; with which they should be repeatedly scrubbed, and afterward thrown into cold water to remain there three or four days till wanted. They should then be scrubbed as before, and well rinsed with cold water; and, before the butter is put in, every part of the inside of the firkin must be well rubbed with salt.

26. Butter may also be preserved sweet without salt, by adding a certain quantity of fine honey,

in the proportion of one ounce of the latter to a pound of butter, and mixing them thoroughly, so that they be perfectly incorporated. A mixture of this sort has a sweet pleasant taste, and will keep for years without becoming rancid.

CHAPTER XLII.

MAKING AND PRESERVING CHEESE.

1. The goodness of cheese, as well as of butter, depends much on the quality of the milk. The season, and particular way of making it, also have a very considerable influence upon it in this respect—more, perhaps, than the material of which it is prepared. We shall, therefore, briefly notice these circumstances.

2. The best *season* for this purpose is from the commencement of June till the close of September. There is no doubt, however, that good cheese may be made throughout the year, provided the cows be well fed in the winter. It is also worthy of attention, that milk abounds most in caseous matter during the spring, and with the butyraceous in summer and autumn.

3. The Cheshire cheese, made in England, is celebrated for its excellence, and we shall give the mode of making it adopted by the Cheshire dairymen.

4. The thermometer of a Cheshire diarywoman is constantly at her fingers' ends. The heat of the

milk when set is regulated by the warmth of the room and the heat of the external air; so that the milk may be the proper length of time in sufficiently coagulating. The time is generally thought to be about an hour and a half.

5. The evening's milk—of suppose twenty cows—having stood all night in the cooler and brass pans, the cheesemaker, (in summer,) about six o'clock in the morning, carefully skims off the cream, which is put into a brass pan. While the dairywoman is thus employed, the servants are milking the cows, having previously lighted a fire under the furnace, which is half full of water.

6. As soon as the night's milk is skimmed, it is all carried into the cheese tub, except about three fourths of a brass pan full, (three to four gallons,) which is immediately placed in the furnace of hot water, in the pan, and is made scalding hot; then half of the milk thus heated is poured to the cream, which, as before observed, had been already skimmed into another pan.

7. By this means all the cream is liquefied and dissolved, so as apparently to form one homogeneous or uniform liquid, and in that state it is poured into the cheese tub. But before this is done, several bowls or vessels full of new milk, or perhaps the whole morning's milk, will generally have been poured into the cheese tub.

8. In some celebrated dairies, however, they do not, during the whole summer, heat a drop of the night's milk; only dissolve the cream in a brass pan floated or suspended in a furnace of hot water. In other dairies, they heat one third, one half, or even more than that of the previous night's

milk. But in all, they are careful to liquefy, or melt the cream well before it is mixed with the milk in the tub.

9. Whatever may be the general custom in any given dairy respecting the heating of the milk, the practice varies according to the weather. It is generally on poor clay lands that the milk most requires warming. On good rich soils, it will not bear much heating; at least, by so doing, the process of cheesemaking is rendered more difficult.

10. The process of making cheese is much more difficult than that of making butter. The quality depends more on the mode of performing that operation than on the richness of the milk. The temperature at which the milk is kept before it is formed into cheese, and that at which it is coagulated, or turned into curds, are objects of the greatest importance in the management of a cheese dairy. The temperature of the milk ought not to exceed 55, nor to be under 50 degrees of Fahrenheit's thermometer. For coagulating, it should be from 90 to 95.

11. If the milk is kept warmer than 55, it will not throw up the cream so well as at the lower degree. It is also subject to get sour and give a bad taste to the cheese. If it be allowed to be much colder than that, it becomes difficult to separate the curd from the whey, and the cheese made from it will be soft and insipid.

12. If the curd be coagulated too hot it becomes tough; much of the butyraceous matter will go off with the whey, and the cheese will be hard and tasteless. The thermometer should, therefore, always be employed in every dairy. Although the

dairywomen may at first be prejudiced against it, yet its evident utility and great simplicity will eventually reconcile them to its use.

13. The greatest care should be taken thoroughly to extract every particle of whey from the curd. No cheese will keep well while any whey remains; and if any part become sour, the whole will acquire a disagreeable flavour. Similar effects are produced by the use of an immoderate quantity of rennet; it is also apt to blow up the cheese full of small holes. This last effect will be produced if it be allowed to remain too long on one side.

14. A very experienced dairyman is of opinion, that from nine to twelve months' time is requisite to ripen a cheese of from fourteen to twenty pounds weight. It is laid down as a rule, in the process of making cheese, that the hotter it is put together, the sounder it will be; and the cooler, the richer, and more apt to decay. It should be kept in an airy but not in a cold place. If the moderately dried leaves of the young twigs of the common birch tree be placed on the surface or sides of cheeses, they will be found very serviceable in preventing the depredations of mites.

15. It is a good practice to strew a little dry moss, or fine hay, upon the shelves on which the cheeses are laid; for when new, they sometimes adhere to the board, and communicate a dampness to it that is prejudicial to the other side of the cheese when turned. It also promotes their drying.

16. At a more advanced stage they may be laid upon straw; but at first, it would sink into and

deface the surface. To which we will add, as general maxims—that great cleanliness, sweet rennet, and attention to the heat of the milk and breaking the curd, are the chief requisites in cheesemaking.

CHAPTER XLIII.

SWINE.

1. The Chinese breed were originally obtained, as their name imports, from China. Of these there are two nearly distinct kinds: the *white*, and the *black*. Both are small; and, although of an extraordinary disposition to fatten, will seldom arrive at a greater weight than 300 pounds, at two years of age.

2. The white are better shaped than the black; but they are less hardy. They are both very small limbed; round in the carcass; thin skinned, and fine bristled; and have the head so bedded in the neck, that when quite fat, the end only of the snout is perceptible. They are tender and difficult to rear, yet, from their early aptitude to fatten, they are in great esteem with those who only rear young porkers.

3. Their flesh is rather too delicate for bacon; it is also deficient in lean. They likewise cut up to disadvantage when intended for ham. However, they possess the valuable properties of being

very thrifty, and of fattening on a small quantity of food.

4. The Berkshire breed has attracted universal admiration. The specific characters are a reddish colour with brown or black spots; sides very broad; body thick, close, and well formed; short legs; the head well placed, and the ears large, and generally standing forward; but sometimes pendent over the eyes.

5. Another distinctive mark of this breed is, that the best are without bristles; their hair is long and curly; and from its rough appearance, seems to indicate coarse skin and flesh: but in fact, both are fine; and the bacon is of very superior quality. The hogs arrive at very large size, and have been reared even to the weight of 800 pounds. All the better and improved breeds are from either the Chinese or Berkshire breed, or from the crossing of these two breeds.

6. The marks of a good hog are a moderate length in proportion to the size of the body; the nose short; the cheek plump and full; neck thick and short; quarters full; carcass thick and full; hair fine and thin; with a symmetry adapted to the breed to which it belongs. Above all, it is essential that it be of a kindly disposition to fatten early.

7. Farmers differ much in their plans of raising holding stock for pork. Some permitting their shoats to run at large eighteen months, till they are penned up to fatten; this is the most troublesome and least profitable way. Others give them a range in clover pastures, and begin to fatten them earlier. I apprehend there is a much more

profitable way, and attended with less trouble for those who have the right breed.

8. According to the quantity of pork wanted should be the number of breeding sows kept over, and there should be no other hogs on the farm [that is, kept over winter] but the breeding sows. These should be fed in the most attentive manner. As soon as the pigs begin to feed freely out of the trough, they should be separated, and afterward fed regularly with green tares, clover, boiled potatoes, ground peas, unmerchantable corn, or any other nourishing food ; turning them out every day into a small yard, where there is a shallow pond for them to lie in.

9. This method, as it is attended with little trouble, and leaves so small a quantity of stock on hand to winter over, appears to me to be more economical, in every point of view, than any other which is practised. Some farmers assert that "March pigs, killed about Christmas, are the most profitable for pork." Others say, "pigs ought never to come until June ; for the cost of earlier pigs exceeds the profit."

10. Some recommend keeping hogs in pastures, with slops from the dairy, &c., till near the last of August ; others say a little later. All agree that near this time they manifest a disrelish for grass. Small patches of peas will then be convenient to turn them into for a few weeks. About the first of September begin with boiled potatoes and pumpkins, mashed together with a little Indian meal, ground oats and peas, or other grain, stirred into the mixture.

11. From two to four weeks before killing time,

the food should be dry Indian corn, and clean cold water. Hogs should never know what liberty is, (unless it be in clover pasture,) but should be kept close all their lives, and as inactive as possible. With this method, almost double the quantity of pork can be produced with the same expense of feed. Young pigs require *warm* meat to make them *grow*. Corn and cold water will make them healthy; but warm beverage is considered as requisite to a quick growth.

CHAPTER XLIV.

DISEASES OF CATTLE.

1. The brute creation are, in general, liable to fewer diseases than mankind; and, as their diseases are less complicated, they are of course more easily relieved. The treatment of sick cattle has hitherto been confined chiefly to the most illiterate persons—to men equally unacquainted with anatomy, and with the relative powers of medicine. Hence many thousands of valuable beasts have necessarily perished for want of that assistance which attentive observation, aided by sedulous inquiries, might have remedied, if not altogether prevented.

2. Various are the maladies to which cattle are liable; though constant and careful examination of their health will greatly contribute to the prevention of diseases. It will frequently happen, how-

ever, that they become sick, either from the effects of our variable climate, or from causes which all the vigilance of the farmer cannot possibly control. It would greatly swell the limits of the present work were we to enumerate every malady incident to cattle.

3. We shall therefore confine our attention to a few of those which are of most common occurrence. But it cannot be sufficiently impressed upon the owner of cattle, that in all sudden cases, it will be his real interest promptly to call in the aid of some expert cattle doctor.

4. *Colds* are frequent attendants in the rearing of numerous animals, and are too well known to require any minute description. In these affections, as in every other malady, prevention is preferable to cure. It will, therefore, be necessary to preserve cattle from undue exposure to sudden blasts of wind, particularly from the northeast, and not to suffer them to lie in wet pastures.

5. Chilling the surface of the body causes an undue determination of blood to some internal organ, which not unfrequently terminates in acute inflammation. The lungs and bowels are more liable to suffer from cold and wet than any other parts of the body, and hence it is that colds often lead to diseases of these parts.

6. When they become confirmed, or settle on some internal part of the body, the affected cattle may be easily discovered by the hollowness of their flanks, the roughness of their coats, the running or weeping of their eyes, and the heat of the breath. Colds prevail chiefly in the brute creation, as among mankind, in those springs which follow

mild winters ; and as they become contagious if long neglected, the diseased beasts should be selected as soon as possible, and separated from the rest of the herd.

7. Formerly, it used to be the practice to keep beasts affected with colds as warm as possible, and no doubt many have fallen sacrifices to this very improper mode of treatment. Unless sweating can be excited, the warm atmosphere in which animals were kept only tended to increase the inflammation. Thus the disease, which at first was confined perhaps to the windpipe, has extended to the lungs, and has either produced inflammation of the membrane lining the air cells, or of the substance of the lungs themselves.

8. As those medicines generally termed sudorifics are not always found to excite sweating in animals, they of course never can be relied on for producing that effect. It is better to keep the beast affected with cold in such a situation that he may breathe a perfectly pure and cool air without being exposed to draughts or wet. In order to relieve the lungs and other parts of the body from the load of blood they are forced to receive, from two to four or more quarts of blood may be drawn, according to the urgency of the symptoms.

9. The *Colic* may be ascertained by the restlessness of the diseased animal, which rises up and lies down almost incessantly, continually striking its head and horns against any object that occurs. Young cattle are chiefly affected by the colic. This disease is attended either with a *scouring* or with *costiveness*, and of course must be treated according to those two circumstances.

10. In the former case, there is generally an acid in the stomach, which should be corrected by the administration of about an ounce or more of magnesia in a quart or more of warm water; and this should shortly be followed by a dose of castor oil. Should the scouring continue after the proper use of purgatives, and the coat be staring and rough, the animal should be housed. Its diet should be nutritive, and wheat-flour gruel, with a drachm of laudanum, if necessary, should be given three or four times a day.

11. *Foul.* This disease effects the feet of cattle. It is generally caused by gravel or some other hard substance getting between the claws. The part affected must be cleansed by washing, in order to discharge the offensive matter contained in the claws; after which they should be dressed with a mild digestive ointment, and kept perfectly clean from all filth.

12. Should, however, ulceration appear, some local stimulant may be applied, and the part should be dressed with a saturated solution of alum. If the disease spread under the horn, this must be freely pared away, and the part dressed with some mild caustic or ointment, according to the state of the parts.

13. *Hoven.* No distemper is of more frequent occurrence among cattle than that of being swollen, *blown* or *hoven*, as it is usually denominated by farmers. It is induced either by too sudden removal from an inferior to a rich pasture, or by eating too eagerly of turnips, clover, or any other succulent food. The stomach is loaded with food, and the process of chewing the cud being

prevented, decomposition takes place, gas is generated, and the animal becomes swollen with confined air, which distends the stomach and intestines.

14. Its preventive is obvious, and consists simply in turning cattle into such rich pastures only when they are not pressed by hunger, so that their appetite may be soon gratified. Or they should be gently driven about for a few hours, that the animals being thus suffered to graze a very short time at once, the stomach may become gradually accustomed to it.

15. *Specific.* Let three quarters of a pint of olive oil, and one pint of melted butter, or hog's lard, be mixed together, and given to the animal by means of a horn or bottle; if no favourable change be produced in a quarter of an hour, the same quantity may be repeated. This dose is calculated for neat cattle: for sheep, when hoven or blown, a wineglass full and a half, or two glasses, will be sufficient to be given in like manner. And it is asserted that this remedy is a specific for the malady in question, effecting a cure within the short period of half an hour.

16. *Looseness*, or *Scouring*, equally affects oxen and cows, though its causes in both are different. In general, it arises either from want of sufficient food, both in quality and proportion; from being overheated or overworked; from feeding on wet, unwholesome fog, or after grass; or on bad hay and straw; and from not being lodged in dry situations; though it is sometimes a hereditary taint.

17. But whatever be the cause, as soon as the scour or lax begins to appear, (and it may be

easily known by the general debility and loss of flesh, the increasing paleness of the eyes, and irregular beating of the pulse, weakness of appetite, &c.,) it will be necessary to house the beast, and put it to dry food; which, in early stages of the disease, will mostly effect a cure. Should the looseness increase, a pound of mutton suet, boiled in three quarts of milk, till the former is completely dissolved, may be given in a lukewarm state.

18. The *Pantas*, or *Panting Evil*, prevails chiefly during the intense heat of summer, though it is sometimes occasioned by sudden colds. It may be easily known by the panting, or heaving, of the animal's flanks, which is likewise accompanied by trembling and decay of flesh. In the treatment of this disease, it will be necessary to house the beast, and give it every six hours (during the continuance of the chilly symptoms) one quart of warm strong beer, in which one table spoonful of laudanum, a similar quantity of ground or grated ginger, and two table spoonfuls of spirit of hartshorn have been previously infused.

19. His food should consist chiefly of sweet dry hay, with warm water, in which nitre may be dissolved, if a fever be approaching; and the animal should be well littered with abundance of straw. As he gains strength, he should be gradually accustomed to the air, and after a short time will be fully recovered.

20. *Poisons.* While grazing abroad, cattle are subject to a variety of accidents, by eating the leaves of yew, various species of crowsfoot, and other acid plants, as well as by bites from mad dogs, or venomous reptiles. In the former case,

the most effectual practice consists in drenching the animal with a mixture of equal parts of lukewarm salad oil and vinegar, afterward giving a gentle purgative of Glauber's salts.

21. With regard to bites of mad dogs, the only remedy is to eradicate the lacerated part, either by excision, or by the actual cautery, the wound being kept open for a considerable time; but in cases of bites by serpents, or vipers, we know of no better remedy than the continued and copious use of spirit of hartshorn, both as an application to the part affected, and also internally as a medicine.

22. The *Staggers*. This disorder is variously known by the names of the daisy, dizziness, epilepsy, lethargy, turning, or vertigo, that sufficiently indicate its symptoms, the chief of which is a lethargic drowsiness, accompanied with a wavering, unsteady, and staggering gait. The seat of this malady is either in the *brain* or in the *stomach*. In the former case, it is usually produced by hydatids, or small transparent bladders filled with water, or by some other matters immediately acting upon the brain. Where this is the cause, medicine can afford no assistance whatever.

23. Where the staggers is caused by plethora, or too much fulness of blood, bleeding and cooling purgative medicines should be resorted to. As it is necessary to confine the beast in a warm stable or shelter, it will greatly contribute to promote the circulation, thus necessarily stagnated for want of exercise, by rubbing him every day with dry straw, and allowing him plenty of litter to promote perspiration.

24. In the *Mad Staggers*, (which disease, how-

ever, is chiefly noticed in horses,) the animal throws itself about with the greatest violence, and exhibits every symptom of inflammation of the brain, which is, in fact, the proper name of the disease. Bleed till the animal faint, and give laxative drenches and clysters, repeating the bleeding if necessary. The diet must consist of bran.

25. *Wounds.* Cattle, in general, are subject to a variety of accidents, which the limits of our work forbid us to specify, and which, indeed, are so numerous, that it is scarcely possible for human foresight to provide for every contingency. Hence our remarks will be confined to the most appropriate remedies for punctures, bruises, or common wounds.

26. In cases of common, fresh wounds, nothing more is necessary than to apply a salve, consisting of white lead, and oil of turpentine incorporated, together with a little brandy, to the lips of the cut, which should be drawn as closely together as possible; and carefully to exclude the air. But if the laceration be deep, it must be washed with warm milk and water; after which, the wound may be filled with lint or tow, dipped in a digestive ointment, composed of Venice turpentine and balsam of capivi, of each one ounce, with two ounces of yellow basilicon. The wound must, as in the former case, be kept from air and dirt, or its healing will be materially retarded.

27. The following remedy has been recommended as a certain styptic for fresh wounds: Bruise equal parts of stinging nettles and salt in a mortar, till a pulp or mash is formed, and apply it to the wound; the bleeding of which, it is

asserted, will *immediately* cease, however deep or dangerous such wounds may be. Not having had experience of its efficacy, we cannot vouch for its utility; but as the articles are always at hand, this specific, if such it be, certainly deserves a fair trial.

28. Where, however, an animal has received any blows or bruises, without breaking the skin, it will be sufficient to bathe the part affected with camphorated spirit of wine; but if the swelling become inflamed, it will be requisite to make a slight incision below the bruised spot, in order to promote suppuration, after which the following salve, or plaster, may be applied.

29. Let frankincense and Venice turpentine, of each one ounce, be gradually incorporated over a slow fire, with two ounces of Burgundy pitch; and, when of a proper consistence, let a sufficient quantity be spread upon a pledget of tow or strong linen rag, and well fastened on with a bandage.

CHAPTER XLV.

DISEASES PECULIAR TO OXEN, COWS, AND CALVES.

1. Oxen are subject to few maladies, exclusive of those incident to neat cattle in general, except the effects produced in these animals by the oxfly, or gadfly, as it is variously termed. This insect has spotted wings, and a yellow breast; it is furnished with a long proboscis, armed with a sharp

dart, enclosing two others within it. The gadfly particularly infests oxen, in the backs of which these insects deposite their eggs, where the maggots are nourished during the month of June.

2. Throughout the summer they plague the cattle by means of their darts to such a degree, that they are often induced to rush into the water for relief till the approach of night. It has been suggested, that the production of these terrible insects might be greatly checked, if not prevented, by washing oxen and cows in the spring with a decoction of tobacco, or any other bitter and acrid vegetable.

3. *Cough*, or *Hoosing*. This disease may be easily known, by the shortness of breath and difficult respiration that invariably accompany it. Sometimes it arises from extraneous matters adhering to the throat, which produce an unusual tickling in that part; but more commonly it originates from *cows'* taking cold.

4. A regular supply of sweet, succulent food, together with warm housing, (especially during the winter,) is the only certain remedy that can be depended upon in this case; though some have recommended one ounce of pulverized aniseed, a similar quantity of tar, and the vinegar of squills, to be infused in a quart of warm ale, sweetened with honey. With this liquor the animal must be drenched every day for several weeks, otherwise no beneficial effects can be expected from such treatment.

5. *Scouring*, or *Looseness*, is generally the first malady that attacks calves. As soon as the looseness is discovered, it has been recommended to

stint the calf in its diet, and to give an egg, boiled hard and chopped small, by drenching, fasting. A mixture of pulverized chalk and wheat meal, made into balls with gin, or strong ale, has also been recommended as a medicine which may be administered with safety.

6. *Cough.* Where calves are exposed, at too early an age, to *all* the vicissitudes of the weather, before they acquire sufficient strength to undergo the changes of this climate, they are liable to take frequent colds; the consequence of which is a *cough*, that often proves fatal if it be neglected.

7. For curing this malady, it has been recommended to pour half a table spoonful of spirit of turpentine into the calf's nostrils, which must be held upward, in order that the turpentine may flow into the throat: at the same time, the nose should be smeared with tar, and the animal kept within doors for a few hours, repeating this treatment as often as the cough is troublesome.

CHAPTER XLVI.

DISEASES OF HORSES.

1. Of all domestic animals, the horse is, perhaps, more liable to disease than any other; and this is not to be wondered at, when we consider the toil he is frequently forced to undergo—the brutality with which he is often treated—the tender age at which he is very generally compelled

to work—and the improper treatment he commonly meets with from those even who are most desirous of using him well, and who, in most instances, err through ignorance.

2. *Botts* are short, thick, reddish worms, surrounded by small prickles, and armed with two hooks or claws, by means of which they attach themselves firmly to the horse's stomach. They frequently exist in such quantities as to cause many serious diseases, not only of the viscus in which they are lodged, but also of the brain and nervous system; with which the stomach is well known to sympathize.

3. Common oil, given fasting, in doses of from half a pint to a pint, has been known to succeed in destroying these insects. But as good a method of getting rid of them as any, is to keep the horse fasting during the night, and in the morning to give him about a pint of warm milk, sweetened with honey; and, five or ten minutes after, a drench composed of one quart of warm water or thin gruel, and four or five ounces of common salt.

4. Several other species of worms exist in the bowels of the horse, and are not unfrequently met with even in the large blood vessels. The most efficacious mode of destroying them, is to give one or two drachms of calomel at night; to keep the horse fasting, and in the morning to administer the following ball:—

Barbadoes aloes	5 drachms.
Ginger	1½ drachms.
Oil of Carraway	15 or 20 drops.
Castile Soap	3 drachms.
Sirup enough to form the ball.	

5. Or a drench made by dissolving four or five ounces of common salt in a quart of thin gruel, and three or four ounces of olive oil. Previous to physicking a horse, he should be kept on warm bran mashes for a couple of days; and care must be taken, after giving the medicine, that he be not exposed to cold or wet, or allowed to drink cold water.

6. A run at grass is perhaps the best remedy for worms; and where this cannot be had, soiling on green food will be found beneficial. Oil of turpentine in doses of three or four ounces in a pint of gruel, is a very efficacious remedy for worms.

7. *Colic* is generally produced by an overloaded stomach; which, impairing the digestive process, causes a great quantity of air to be formed, which distends the stomach and intestines, and produces those symptoms hereafter to be noticed. It is also frequently induced by allowing a horse to drink cold water or hard well water, or by feeding him on new oats or hay.

8. As this disease, unless relieved, is liable to terminate in inflammation of the intestines, it may perhaps always be proper to bleed to the extent of two or three quarts. Also, to administer a clyster made of half a pound or more of common salt, and five or six quarts of warm water or gruel; to which may be added half a pint of olive oil.

9. Then gin and water, and brandy and water, are perhaps as good medicines as can be had for this purpose, and possess the advantage of being more simple. Four ounces of spirit to twelve of water, are the proportions in which they may be

used; that is, one pint of spirit and water should contain one fourth spirit and three fourths water. Should the animal not appear relieved in the space of half an hour, the above remedies may be again resorted to with greater freedom.

10. The symptoms of colic are as follows: The horse appears restless and uneasy; frequently paws his litter; looks around at his flanks; falls down; rolls on his back; gets up suddenly, and after a short time falls again, with other demonstrations of extreme pain.

11. *Cold*, or *Catarrh*. This disorder is generally induced by exposing a horse to cold or wet while in a state of perspiration. Its symptoms are dulness and watering of the eyes, cough, discharge from the nostrils, sore throat, quickness of breathing, general lassitude, and accelerated pulse. (*A healthy horse's pulse beats from thirty-six to forty strokes in a minute.*)

12. As catarrh is an inflammatory complaint, it is proper in the first instance to bleed largely: five or six quarts of blood may be drawn, unless the animal becomes faint before that quantity be abstracted. The diet should consist of bran mashes, containing a small quantity of nitrate of potash, (about half an ounce,) given three times a day; and the horse should be kept in a cool stable, or loose box, or turned into a dry yard.

13. When the throat is very sore, an emolient drink, composed of decoction of marsh mallows, or flaxseed with mucilage of acacia and liquorice, may be given. When catarrh terminates in chronic cough, the best remedy is attention to diet, exercise, and grooming. The horse should never be al-

lowed to overload his stomach, especially with hay; his bowels should be kept moderately open by means of bran mashes or clysters, when requisite.

14. Take one ounce of bruised squills, three of garlic, and twelve of vinegar; macerate the squills and garlic in the vinegar for one hour in a moderately warm oven; then strain off the liquid, and add one pound of honey or molasses. Three or four ounces of this mixture may be given at a time in bad coughs; and when great irritation appears to exist about the windpipe, one teaspoonful of tincture of opium may be added to every dose.

15. *Bruises* should always be poulticed, or fomented with hot water. A towel dipped in greasy water is a good application. *Galls.* When a horse is galled by the saddle or harness, or when he is chafed between the arm and chest, an accident which frequently happens in travelling through muddy roads, the following lotion will be found serviceable:—

Sulphate of zinc	1 ounce.
Super acetate of lead	1 ounce.
Water	1 quart.

16. *Strains.* The best method of preventing the inflammation attendant upon a strain is, immediately on the receipt of the injury to bleed and wrap the injured part in a large poultice. The horse should then be physicked and kept to a low diet. Some people, instead of poultices, employ cold applications; as

Super acetate of lead	1 ounce.
Vinegar	4 ounces.
Water	1 pint.

Their effect is the same as the poultice; each tending to reduce inflammation. On the whole, we are inclined to give the preference to the poultice.

17. When a strain is neglected for some time, and the inflammation has gone off, bleeding will be improper. Blistering, and, in some cases, firing must be resorted to. There are several sorts of strains; as strains of the back sinews, of the pastern joint, of the shoulder, loins, &c.; but our limits do not permit us to give a detailed account of their different symptoms. The rationale of their treatment is in all cases the same.

CHAPTER XLVII.

SHEEP.

1. The Saxon and Spanish merino, South Down, New Leicester, Bakewell, and Policerate are some of the best varieties. The Saxony sheep imported into this country were from a variety of flocks, of which the electoral was the parent.

2. The Saxon and Spanish merino are the most profitable sheep for fleece. The electoral were originally from Spain. At the beginning of the eighteenth century, one was carried from Spain as a present to the Elector of Saxony; and from thence they derived their name. The South Down and New Leicester are the most proper for their

mutton. The Policerate are remarkable only for their four horns.

3. *Proper Soil.* Sheep delight in pure, free air and, dry pasture, and seem constitutionally fitted for rocky and stony situations; and, indeed, it is the opinion of many intelligent men, and with much reason, that stony uplands are essential to their health; that on rough, dry soils, they are not so subject to the many diseases which afflict them, as when kept on moist, soft places.

4. Sheep, if fed in a country of plains and rich pasture, increase in size, and their fleece becomes heavier and coarser. If in an elevated country, where the pasture is short and thin, the size and fleece diminish, while the texture of the latter is improved.

5. *Caretaking.* As soon as sheep are brought into the yard for winter, the different kinds of lambs, ewes, and wethers should be carefully separated, and kept apart. It is important that those in one yard should be as nearly of a size as possible; then there will be no stronger ones among them, to drive the weaker ones from their food. All will then feed alike and do well.

6. The flocks ought to be as small as we can conveniently make them. Each flock should not consist of more than from fifty to one hundred—fifty is the better number.

7. It is also necessary to have a separate yard for old and poor sheep, and if there are any in the flock that do not subsequently thrive well, they should be removed into what is commonly called the hospital.

8. These hospital sheep, by being few in number, having a good warm shed, a sheaf of oats, or a few screenings from under the fanning mill, once a day, will soon begin to improve.

9. Sheep ought to be rather sparingly fed, three times a day, and out of racks, to prevent them from running over and trampling on the hay. It is of service to give them a feeding of straw, or pine tops, if you please; it invigorates their health, and makes a change in their food.

10. They should be daily watered, and if their hay has not been salted, likewise have a lick of salt occasionally. Sheep should have access to sheds, where they may be fed in stormy weather.

11. If they can always go to a shed, they will resort to it as an indulgence; this indulgence will soon become a habit; they will have no inclination to motion, but will become debilitated and lose their appetite. It would be well for farmers to make it a practice to count their sheep once a day, to see if any are missing; to examine them, and see if any are sick, and if there are, to remove them from the flock, and take care of them until they are entirely recovered.

12. *Raising Lambs.* Lambs should not be shorn the first season; they need their fleece to protect them during the cold weather, and it is found that nothing is gained by early shearing. Lambs should always be left at home when sheep are to be washed, as they are saved much fatigue; besides the advantage of having the sheep go directly home after washing, without any trouble.

13. To ensure the life and health of every lamb, the ewes should be in good condition—should be

fed with fresh grass, as it adds greatly to the quantity as well as quality of the milk. Lambs should be taken from the sheep the last of August; and then fed, for three months, on oats in the bundle.

14. Lambs will live twenty-four hours, and even longer, without any nourishment; and, as a general rule, should not be fed until you discover by their actions they are seeking food; then they will drink without any trouble. They should be furnished with as much milk as they will drink.

15. *Food.* Sheep should have plenty of salt. They should be fed on carrots, potatoes, turnips, and a little coarse grain occasionally. If you have not these roots, provide them another year; for there is no spring food more profitable than turnips. They are extremely nourishing, and tend greatly to enrich and increase the milk of the ewes.

16. Sheep, through the winter, should be fed on rutabaga and mangel-wurtzel, regularly, once a day. Dry provender and green food which do not abound in cold and watery juices, are most appropriate and salutary for them.

17. *Diseases of Sheep.* The diseases of sheep are various, and often prove fatal. They, therefore, need our attention. Of these diseases, the most to be feared is *rot*, which often extends over whole districts of country. It prevails most in wet seasons, and at this time is the most fatal. The chief cause of this disease is pasturing on wet land. It is well known that sheep kept on dry soil are seldom, if ever, troubled with *rot*.

18. The animal affected does not at once show symptoms of disease, but frequently remains for a

long time in apparent health; and likewise shows a great tendency to feed.

19. The signs of rottenness in sheep are undoubtedly familiar to all shepherds. The sheep becomes emaciated, its eye becomes heavy and glassy; the wool, on being pulled slightly, comes readily from the skin; the breath becomes fetid; and as the disease progresses, the skin is often marked with spots, and the waste of flesh increases until the sheep dies.

20. The *rot* often attacks a large flock at once, and sometimes only two or three of a flock. During the progress of this disease, the fluke, a small animal, appears on the parts connected with the liver. These animals increase as the disease advances; and are sometimes very numerous.

21. *Remedy.*—Salt, in most cases, prevents and cures this disease. As soon as the symptoms appear, salt should be placed near the animals in pans or troughs, in large quantities; and the sheep will readily consume it. In the early stages of this complaint, change of food is highly beneficial; this alone, in some cases, has been found sufficient to effect a cure.

22. *The Hunger Rot.* This arises from the want of sufficient food, which produces an unhealthy state of the bowels, leanness, and often death. In this disease the wool generally falls off the animal. *Remedy.*—Plenty of nutritious food.

23. *Pining.* This disease is common among sheep, and sometimes proves very fatal, destroying whole flocks. This disease arises from the want of exercise, the want of water, and from feeding on very dry pasture. They should also have

access to running water. *Remedy.*—Change of food will very often remove the disease; if this should fail, the sheep must be removed to a richer and moister pasture. They should have access also to a running stream.

24. *Diarrhœa* or *Dysentery.* These are also diseases of sheep. Diarrhœa is most generally produced by a too hasty growth of grass in spring. It is frequently hurtful to lambs. *Remedy.*—The sheep should immediately be removed to a drier pasture; and be fed with corn until they recover.

CHAPTER XLVIII.

SHEEP—CONTINUED.

1. *Scab.* Sheep are also troubled with diseases of the skin. The principal one is called scab; it may be known by the extreme itching, and eruptions of the skin. *Remedy.*—Flour of sulphur mixed with a little lard or fresh butter. The wool should be opened, and the skin well rubbed with this preparation. A decoction of tobacco, and spirit of turpentine mixed with a little soft soap, have also a very good effect.

2. The decoction of tobacco may be obtained by boiling the tabacco in brine or salt water. The liquid, when prepared, is applied from a vessel like a teapot with a spout, or from a bottle with a quill passed through the cork. A person lays the wool back in lines so as to expose the skin,

and then pours out the liquid along the lines upon it

3. If the distemper be very violent, a mercurial preparation will be necessary. This can be procured in the apothecary stores, under the name of sheep ointment. It is made in balls, and when used, it is dissolved in oil, and applied to the skin.

4. *Foot Rot.* This is an inflammation of the foot, followed by breaking out of sores in the hoof. It generally occasions the entire lameness of the animal. *Remedy.*—The tainted part of the hoof must be pared away, and the ulcerous matter removed; the foot should then be washed with soap and hot water, and the surface be dressed with some caustic, the best of which is muriate of antimony.

5. In the early stages of this disease it can be cured by paring, and by cleansing the hoof with soap and water, and dipping it in boiling tar. Another remedy for this disease: The hoof should be scraped clean, and spirit of turpentine poured in. This should be done once in eight days till the cure is effected. Three or four applications are generally sufficient.

6. *Hydatids*, or *Water in the Head.* This is a common occurrence. The cause of this complaint is a small animal, which finds its way into the brain; which, if not speedily removed, causes the death of the sheep. This creature resembles a bladder filled with water, and for a long time was supposed by many shepherds to be water.

7. The hydatids is frequently found in other parts of the body, as the liver and spleen. When the brain of the sheep is diseased it shows symp-

toms of great pain; leans its head to one side, and continues turning round, and finally dies.

8. *Remedy.*—The remedy for this complaint is to reach the hydatids, and to extract it, or to pierce it in such a manner as to destroy its life. When it is situated at the surface of the brain, the part feels soft, and it may be reached by an awl, or by a sharp penknife. A little round piece of the scull is to be cut, and lifted up like a lid.

9. The hydatids being made bare, is to be taken out with pincers, and the liquid absorbed by a small sponge. The scull is then to be put back into its place, and dressed with tar on a bit of kid. When the hydatids is in the heart of the brain, it can be reached by putting a fine wire up the nostrils.

10. *Sheep Bug.* This generally prevails where the sheep are in an unhealthy state. The bug is of a flat form; and is found about the throat and other parts, and occasions great irritation. *Remedy.*—Turpentine, tar, or tobacco juice, seldom fails to effect a cure.

11. *Sheep Maggot.* This is the most destructive enemy that attacks sheep. The fly lays her eggs on the skin of the sheep, and the larvæ are hatched in great numbers, and grow with astonishing quickness. They frequently spread over the whole body, and consume the skin, and eat the flesh.

12. The sheep manifest great suffering, and run with great rapidity, until they become exhausted, and finally lie down and perish. In moist and warm seasons, the maggot is most troublesome. The shepherd should be careful to inspect his

sheep every day, and clip away all the dirty pieces of wool. *Remedy.*—The maggot may effectually be destroyed by a solution of the corrosive sublimate.

13. *Cure for Sheep Ticks.* Take for fifty sheep about two pounds of tobacco, soak it five or six days in two gallons of water; then strain the liquor off: put into a pot over a slow fire five quarts of tar, ten quarts of lard, stir them well till melted; then pour it into the tobacco liquor, mixing it thoroughly.

14. Then add thirty-five quarts of old buttermilk; and when about milk warm, take a sheep, lay it on its side, open the wool, and apply the remedy; taking care at the same time to keep the sheep in such a position that the liquid will run all over the skin, and not on the wool. One quart is sufficient for each sheep. A vessel with a small spout should be used, to prevent its pouring too fast, or spilling over the wool.

15. The right time for this operation is a warm dry day about the first of March. *Shearing.* This should be performed about the fifteenth of June, after the cold rains have subsided. Great care should be taken, while shearing, not to cut the skin of the sheep; as it not only makes the animal poor, but makes the wool which grows over the cut places much coarser.

16. *Care of the Wool.* Greasing the sheep once every six months is highly recommended by some; as it is thought beneficial to both the carcass and the wool. Wool which has been shorn two or three years does not spin or fill so well as when kept only one year.

17. Wool should be kept in a dry, but not a very warm situation. The wool intended for exportation should be carefully folded up, each fleece by itself, and tied and sent to market. The best wool is raised on healthy sheep, and on those which are usually kept in good order, and receive proper food.

18. *How to tell the Age of Sheep.* The age of sheep may be known by examining the front teeth. They are eight in number and all of a size; and appear the first year. In the second year, the two middle ones drop out, and two larger ones supply their places. The third year two other small teeth, one from each side, fall out, and are replaced by two large ones; so that there are now four large teeth in the middle, and two pointed ones each side.

19. The fourth year there are six large teeth, and two small ones remaining, one at each end of the range. In the fifth year, all the small teeth are lost, and the whole of the front teeth are large. In the sixth year all begin to be worn, and in the seventh some drop out or are broken.

CHAPTER XLIX.

THE FARMYARD.

1. No subject of rural economy is of greater importance than the judicious disposition of the outbuildings of a farm; yet there is, perhaps, less

consideration bestowed on this point than on any other. It is obvious to the most common observer, that the size of the various outhouses ought to be regulated by the extent of the farm, and also by that branch of husbandry which is carried on.

2. In a dairy farm, there are fewer buildings requisite than in any other department of agriculture; but it is nevertheless highly necessary to have distinct buildings for the various sorts of cattle; and the whole of these should be so arranged and distributed as to facilitate the operations of the labourers.

3. Further to promote this object, the whole of the buildings should, if possible, be placed within the same enclosure. The yard in which they are situated should also be secured against all outward access; if the buildings are not so connected as to form a complete enclosure, the spaces between them should be filled up with wall, or high paling, and the yard should be closed by solid gates.

4. Where chalk can be commanded, the surface or bottom of the yard should be bedded or coated with it, or with some other material impenetrable to water; by which means the moisture, in the smallest degree, will be effectually prevented, and consequently a great saving obtained in the article of manure. The construction of the yard should be nearly concave, or shelving to the centre, in order to collect the drainage.

5. In order to avoid this expense, which is, in fact, very trifling, most farmers bottom the yards with earth, or rubbish, to absorb the drainage, and thus form a compost in the yard itself. This saving, even were it larger, can be of no impor-

tance in comparison with the injury done to the store cattle by thus retaining the moisture underneath them. Dryness of situation is of the most essential consequence to their health, and indispensable to their thriving.

6. The driest bottoming is furze; but stubble, potato tops, or any other loose refuse, will answer the purpose; over which the yard should be bedded deep in straw. Earth, though most valuable in a compost, should never be used within the yard. Of the principal offices requisite to a farm, we now proceed to give an outline.

7. *Ox Stalls* or *Feeding Houses.* The structure of these buildings is very simple. It is requisite that each interval, or stall, should not only be provided with a crib, for dry food, but there should also be, in the centre of each, a trough, for the reception of water, which may be conducted into them by means of tubes leading from the pump. The *size* must depend upon the manner in which the farm is occupied; but it ought never to be forgotten, that the beast should have *ample accommodation.*

8. In order to erect feeding houses to advantage, great attention should be bestowed on their situation. They ought to lie dry, and not be exposed too much to the sun, or to the heat of the weather. It will be advisable to lay the floors in a gently sloping direction, with proper drains, and also for the more easy removal of the litter.

9. The floors are variously paved. By some it has been recommended to have the pavement of stone pitched; but the least expensive method is to lay the floor with bricks. The doors also should

be so hung as to open outward, by which means a waste of room will be prevented, and the sheds will be rendered more secure against intruders. Their safety will also be greatly increased by hanging them with a fall to the catch.

10. The *width* of stalls is various. For two middle-sized working oxen, *seven* feet have been found sufficient, and *nine* feet for those of a larger size. Cows require equal, if not more room, for the convenience of milking them; and it is always best to place them in single stalls. The stalls should not be made too wide, lest the cattle turn round in them; for thus the stronger beasts would have an opportunity of injuring their weaker fellows. This danger may be avoided by placing a post in the middle of the stall, immediately before the shoulders of the cattle.

11. Where the system of stallfeeding is adopted on a large scale, it will be necessary that there be a *regular temperature* maintained. Otherwise the confined respiration of many animals must necessarily tend to generate disease. Hence, though a loft may be built over the stalls for the reception of provender, a funnel may be passed through it from the ceiling of the feeding house to the roof, which will allow of the escape of the foul air.

12. It will also be advisable to construct latticed windows, or apertures, at a considerable distance from the ground, at the gable ends of the feeding houses, and to supply them with shutters, which may be closed or withdrawn as the season of the year, or the temperature of the weather, may render necessary. Where it is practicable, such

openings should be towards the north or east, in order that they may derive some benefit from the genial rays of the morning sun, and from the cooler air of the day in summer. The large front doors may sometimes be set open for the purpose of further ventilation.

13. Various modes are employed for securing cattle in their stalls; but when the common method of tying up is insufficient for the security of vicious beasts, the following will be found to answer the purpose: A fixed iron chain, by way of a halter, should be fastened to a *standard*, mortised into the front side of the manger and the joist above.

14. It is composed of two parts: one of these has sixteen links, and is two feet in length, measuring from the staple; the other, which contains twenty-six links, measures about thirty-nine inches, and serves as a collar. At one end of this *collar chain* there is a ring, about one inch in diameter, and at the opposite extremity a key, three or four inches in length, having a hole at its middle, by which it is joined to, and freely plays in the last link.

15. The first chain, which by one end is fixed to the manger, is by the other linked into a middle link of the collar chain, and thus forms two arms, which, being thrown round the neck of the beast, and the key being thrust through the ring, and placed at a bar across it, make a very secure fastening.

CHAPTER L.

THE FARMYARD—CONTINUED.

1. Among the smaller buildings of a farm, not the least worthy of notice is a *cart* and *tool house*, for the reception of the wagons and implements, which, when not actually employed, are often heedlessly left on the spot where they are last used.

2. An open spot, free to every wind, should be selected. The roof ought to be supported on pillars, high enough to admit a loaded wagon, and containing lofts for the care of light implements, sacks, or other small spare articles. But as the only object is to preserve the carriages and tools from the effects of wet, this can be attained by mere sheds, the most economical mode of erecting which is, to project a roof from the back of a barn or stable.

3. *Calf Pens.* In most parts of this country, it is the practice to appropriate a part of the cow-house to the reception of calves; a measure which cannot fail of producing uneasiness among the cows, which often withhold their milk in consequence of the bleating of the young animals. It is preferable to have the pens at such a distance from the feeding house that the cows cannot hear them.

4. The construction of these buildings is so simple and so well known, that a particular description is deemed unnecessary. They should

be latticed, so as to admit fresh air, as a moderate and rather cool temperature ought at all times to be kept in calf pens. Light should be excluded, as darkness inclines all animals to rest, and the quieter calves are kept, the better they will thrive. The strictest cleanliness should also be observed, and every attention paid to keep them dry and sweet.

5. If possible, they should open either into the stackyard or the orchard, or some small and quiet enclosure, in order to afford an opportunity of occasionally turning out calves that are intended to be reared. When the profit arising from the rearing of swine is duly considered, it will be admitted, that the rearing of a *piggery* demands nearly as much attention as a dairy.

6. A piggery should be in a circle, or it must fail in convenience. According to this idea, in the centre there should be the boiling or steaming house, with a granary for corn, meal, &c. Around this, a range of cisterns ought to be disposed, in divisions, for receiving immediately from the steam apparatus, and also by tubes from the granary.

7. Around these should run a path, then a fence or paling, in which are the troughs, with hanging lids, for supplying food directly from the cisterns, on one side, and for hogs feeding on the other. A range of yard next. The potato stores, or *pyes*, should at one end point near to the entrance, and water must be raised to the coppers and cisterns at once by a pump; a trough, or other conveyance from the dairy to the cisterns, for milk, whey, &c.

8. An arrangement like this would be very convenient, while the expense attending it would be inconsiderable. Great profit might be derived by setting apart a plot of natural or artificial grasses, into which the swine might be turned at pleasure. Those who do not possess a convenient pig apparatus, can have little idea of the great use of it in making manure. This alone becomes an object, that would justify any good farmer in going to a certain expense, for attaining so profitable a part of what ought to be his farmyard system.

9. This plan, however, is calculated only for those farms where the fattening of swine is carried on extensively. Where these animals are kept chiefly for domestic consumption, it will be sufficient if hog sties be constructed with due regard to warmth and dryness, and divided into various partitions for the reception of swine, according to their age and varieties.

10. Each division should be between six and seven feet in width, of such height as the largest pigs can conveniently enter, and should be provided with a small space sufficiently capacious for holding the feeding troughs.

11. If possible, troughs should be so arranged, that offal, milk, &c., may be conveyed into them from the milkhouse, or scalding house, by means of pipes ; and as these animals often thrust their feet into the troughs, and thus waste a considerable portion of food, this may be avoided by fixing sticks in a frame over the troughs, not unlike a rack ; or a thin piece of plank may be nailed on the back part of the troughs, and so project as to allow their heads only to enter.

12. This object may also be attained when swine are put up to fatten on dry food, by fixing a conical hopper (holding any given quantity) in a trough with the broad end upward, and covered with a strong lid. At the lower end should be an aperture for giving out the meat into the trough, where the animal may eat it as it falls, without being capable of spoiling or wasting any portion of it.

13. By adopting the expedient here suggested, the further advantage will be derived in fattening swine, that, by feeding more leisurely than in the common mode, their food will probably be more thoroughly masticated; the effect of which has been thought to render their fat more firm, and of a better flavour.

14. *Root Houses* are buildings, the utility of which, on those farms where the system of stall-feeding is adopted, is very great. They should adjoin the feeding house, and be provided with a *steamer*, for the purpose of preparing the vegetables for the use of the cattle. This simple machine, in fact, is indispensably necessary on all farms where the feeding of cattle is conducted to any extent, and will not be found useless even on those in which it is not an object of attention.

15. An apparatus for steaming consists of a brick or stone stove, about three feet in every direction, in which is fixed a pot or kettle, six or eight inches deep, and eighteen or twenty inches in diameter. Over this boiler (when about half full of water) is placed a hogshead, or cask, the bottom of which is perforated with numerous holes,

about an inch in diameter, so that the steam may freely pass through the roots.

16. The top of the cask is usually left open, which might more advantageously be covered with a thick coarse cloth. The cask may either be removed by a rope and pulley, suspended from the ceiling, or it may be turned over when the roots are sufficiently steamed.

THE END.

DICTIONARY
OF
TECHNICAL TERMS.

Agriculturist, a farmer.
Attraction, the power by which bodies tend towards each other.
Affinity, an agreement between bodies.
Acidifying, souring.
Aqueous, watery.
Ammonia, a light thin alkali.
Assimilation, uniting several bodies into one of the same nature.
Alumina, a primitive earth, pertaining to alum.
Arable, fit for ploughing.
Argillaceous, clayey.
Azote, a gas destructive to animal life.
Acrid, sharp, biting to the taste.
Agrostis, bent grass.
Acetous, sour.

Ad infinitum, indefinitely, without end.

Berkshire, a place in England.
Biennial, continuing for two years and then perishing.
Bona fide, truly in good faith.

Chemistry, the science that discovers the nature and properties of matter.
Cohesion, a kind of attraction, a force that draws particles of matter *of the same kind* together.
Crystallization, the act by which separate parts unite and form a regular solid body.
Caloric, a very thin subtle fluid, that which causes the feeling of heat. Heat is the name of the feeling produced by caloric. Caloric is diffused thro' every thing.
Combustion, the act of burning.
Carbon, one of the simple elements.
Calcareous, having qualities of lime.
Caustic, corroding.
Corrosive, eating, wearing away.
Calcined, converted into a powder.
Cocoon, a ball of silk in which the silk-worm winds itself.
Cylinder, a long circular body, a roller.
Costiveness, tightness of bowels.

Digestion, preparing food in the stomach for nourishment.

Drench, a portion of medicine.

Electric, from electricity, which means an invisible subtle fluid, diffused through all nature.

Expansibility, the capacity of being enlarged.

Elasticity, the property in bodies by which they recover their former figure, after pressure or being pulled.

Friction, the effect of rubbing one body against another.

Fluidity, capable of flowing, a liquid state.

Feldspar, a mineral made up of thin scales.

Farina, the pollen, the fine powder on the plant.

Geology, the study of rocks.

Gravitation, the force which draws bodies together, or to the centre of the earth.

Gases, simple substances in the form of vapors.

Galvanic apparatus, an instrument that developes electricity without the aid of friction for some chemical effect. It produces an intense heat.

Gravity, that force which draws bodies to the centre of the earth.

Gelatine, a mixed animal substance, dissolvable in water.

Hydrogen, a primary part of water, a simple element.

Hygrometer, an instrument for measuring the moisture in the atmosphere.

Hectolitre, a measure containing nearly two bushels.

Hydraulic pressure, water pressure.

Lime, calcareous earth.

Liquids, bodies that flow, like milk, water, &c.

Leguminous, consisting of pulse.

Mineralogy, the study of ores, minerals, &c.

Marl, a kind of earth possessed of considerable lime, vegetable or animal matter.

Mangnetic, from magnetism.

Maganese, a metal of a dusky white.

Magnesia, one of the primitive earths.

Mica, a mineral made up of thin limber scales, having a shining surface.

Marl, a mixture of lime and clay, and lime and sand.

Nitrogen, an original element, found in air and in many other substances.

Oxidized, rusted.

Oxygen, one of the elements of the air—that part of the air which supports life.

Plaster, a union of lime, sulphuric acid and water.
Phosphorus, a combustable substance, of a yellowish color. It burns very readily.
Pearlash, refined potash obtained from the ashes of wood.
Petrifaction, soft substances changed to the hardness of a stone.
Piggery, a hog-pen.

Quartz, a hard flinty mineral.

Repulsion, a power that drives particles of matter from each other.
Radiating, passing through.
Reflecting, throwing back rays of light and heat.
Residuum, remainder.

Stimulating, exciting.
Solids, hard bodies, such as do not run like water.
Safety-valve, a moving valve to let off steam from the boiler.
Salt-petre, a substance formed by uniting potash and nitre.
Silicia, one of the primitive earths. It is hard and

flinty, and is generally found in the state of stone.

Substratum, under layer.

Silicious, hard, stony, flinty.

Saccharine, having the qualities of sugar.

Spatula, a flat stick for spreading or stirring.

Thermometer, an instrument that discovers the degree of heat that may be in any thing.

Vacuum, an empty place having nothing in it, not even air.

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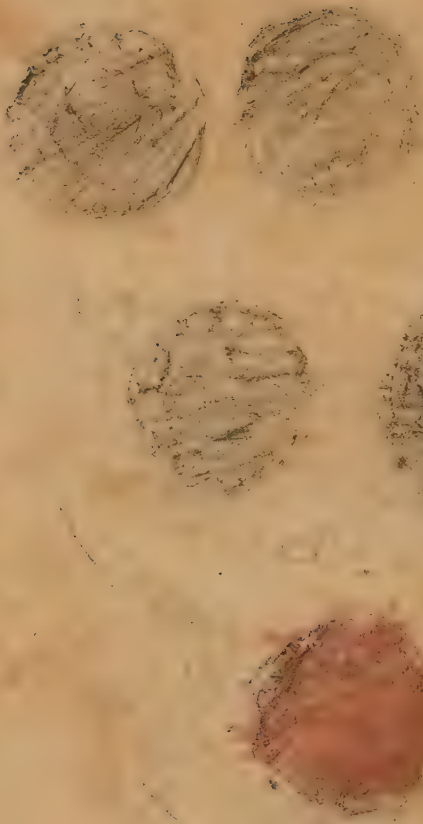

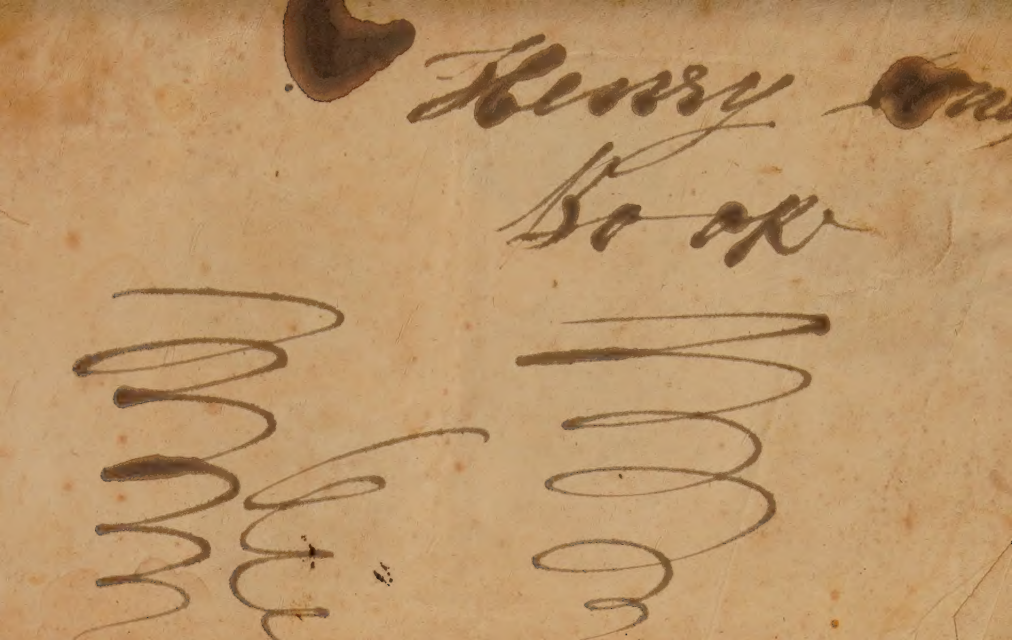

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